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A

PRACTICAL TREATISE

ON THE

DISEASES OF THE LUNGS.

A
PRACTICAL TREATISE
ON THE
DISEASES OF THE LUNGS:
INCLUDING
THE PRINCIPLES OF PHYSICAL DIAGNOSIS,
AND
NOTES ON CLIMATE.

BY
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CONSULTING PHYSICIAN TO THE HOSPITAL FOR CONSUMPTION.

"Verum ipsum cognito vera e rebus ipsa . . ."—JUL. SCALIGER.

FOURTH EDITION, REVISED AND MUCH ENLARGED.

LONDON:
SMITH, ELDER & CO., 15, WATERLOO PLACE.

1871.

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1871

TO

RICHARD QUAIN, F.R.S.,

LATE PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,

WITH SINCERE RESPECT FOR HIS PUBLIC CAREER

AND IN

CORDIAL ACKNOWLEDGMENT OF LONG YEARS

OF FRIENDSHIP.

ADVERTISEMENT TO THE FOURTH EDITION.

THE present edition has been carefully revised and much enlarged, and may be said to be, in a considerable measure, re-written.

Descriptions of several diseases, previously omitted, are now introduced,—among these may be mentioned dynamic and structural affections of the diaphragm. The large class of diseases, characterised by the presence of morbid deposit in the lung, is arranged upon a new plan; and fresh attention has been bestowed on some members of the Tissue-destroying group of these, as, for instance, Syphiloma, Cancer, and Caseous Infiltration.

In the third, an additional, Part, the subject of change of climate is entered into with as much fulness, as seemed compatible with the pretensions of the book. It is hoped, the condensed accounts of the leading classes of climates, and of the more important winter Sanitaria, resorted to by pulmonary invalids, may be found to furnish the busy practitioner with an available climatic guide.

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PART I.

PHYSICAL EXAMINATION OF THE LUNGS AND APPENDAGES.

"Who knows but that one may discover the works performed in the several offices and shops of a man's body, by the sounds they make, and thereby discover what instrument or engine is out of order?"—R. Hook, 1705.

INTRODUCTION—CLINICAL TOPOGRAPHY OF THE CHEST.

1. THE existence of disease involves that of anatomical change, not only in the part originally and chiefly affected, but also in the structures immediately adjoining. There are a few apparently pure dynamic diseases, forming in the present state of knowledge putative exceptions to this proposition; but, admitting their reality, they are not sufficiently numerous to negative the general truth.*

2. The anatomical changes thus arising may or may not be capable of accurate discrimination during life. When they can be so discriminated, experience has shown that their detection is not so much accomplished by means of the vital functional derangements of the organs implicated, as by the aid of various alterations in the physical properties of those organs,—as, for example, their density, their faculty of generating and of conducting sound, &c. So invariably do these alterations bear a certain and fixed relation to the physical nature of the anatomical conditions with which they are associated, that the discovery of the former is conclusive as to the existence of the latter. And not only the physical nature, but the precise limits and the precise degree, of these conditions are disclosed by the alterations referred to,—which, for these reasons, constitute their *Physical Signs*. Interpreted by the

* That an imperfect act should result from the activity of a perfect instrument seems hardly a logical conception. And the doctrine that certain so-called "functional" diseases are constituted purely and alone by excess or insufficiency, altered speed, perverted rhythm, or modified association of the molecular changes *normally* attending structural acts, remains as yet mere matter of assumption.

observer, and not by the patient,—incapable, except in the rarest instances, of being feigned, dissembled, or even modified at will,—estimable in degree and extent with almost mathematical precision,—susceptible of indefinite refinement,—physical signs, like the whole class of objective phenomena of disease, are of immeasurably greater diagnostic, and considerably greater general clinical value than its subjective symptoms. Physical signs are, in fact, such accurate exponents of the physical conditions, extent and degree of textural changes, that, although they convey no direct information as to the pathological nature of those changes, they may fairly be regarded as instruments of pursuing morbid anatomy on the living body. But just as their significance is sure and precise, so is the difficulty of establishing their theory and mastering their practice positive and great; and hence it is that Physical Diagnosis has gradually acquired for itself the importance of a special art.

3. The means by which physical signs are discovered or elicited, are called *Physical Methods of Diagnosis*; and these methods vary with the textural properties, functional attributes, and peculiarities of site of the organs examined. The diseases of the organs of respiration are among those of which the physical signs are the most varied, most significant, best understood, and most readily ascertained. The *methods* employed for their detection are:—

I. INSPECTION; II. APPLICATION OF THE HAND; III. MENSURATION; IV. PERCUSSION; V. AUSCULTATION; VI. SUCCUSSION.

These methods are, as nearly as is possible, applied to the parts themselves of which we desire to ascertain the condition,—to the external surface corresponding to them, when inapplicable to themselves. But the absence or presence of disease in the different thoracic organs, and, if it exist, its nature, may sometimes be indirectly inferred by employing these methods in—

VII. THE DETERMINATION OF THE SITUATION OF CONTIGUOUS PARTS AND ORGANS,—which may consequently be considered an additional method of physical diagnosis.

4. All these methods agree in the general character of their direct and indirect objects. The *direct object* the physician has in view with all, is the just appreciation of the sensations they furnish, and these are nothing more than the physical signs already spoken of; the *indirect object*, the reference of these signs to the physical states upon which they depend.

But a deeper object, to which these are merely preparatory, remains behind,—the determination of the pathological nature of

these physical states. For this, familiarity with the laws of localisation, alliance, progress, and reciprocal influences of thoracic diseases is indispensable. Physical signs, it cannot be too emphatically stated, reveal physical conditions alone; they give no direct insight into pathological nature.

5. With the view of localising physical signs as precisely as possible, the surface of the chest has been divided into artificial regions; but as the assignment of limits to these regions is altogether arbitrary, it is not to be wondered that the boundaries adopted by different writers vary. Simplicity, as far as is compatible with the main object, should be especially aimed at in all such topographical arrangements; yet it scarcely appears possible, without a sacrifice of utility, to make the number of divisions less than in the following plan. They are designed to correspond, as far as is attainable, with important internal regions or outlines.

6. The chest is divided into anterior, lateral, and posterior regions. The *anterior* are called: supra-clavicular, clavicular, infra-clavicular, mammary, infra-mammary, supra-sternal, upper sternal, and lower sternal. The *lateral* regions are: the axillary, and infra-axillary. The *posterior* group comprises: the upper scapular, the lower scapular, the infra-scapular, and the inter-scapular. Of these regions the supra, upper and lower sternal are single; all the rest are double.

7. The boundaries of these regions, and the more important structures and portions of organs corresponding to them, either within the chest or on its confines, may be stated as follow:—

8. *Supra-Clavicular*.—Boundaries: above, a line drawn from the outer part of the clavicle to the upper rings of the trachea; below, the clavicle; inside, the edge of the trachea. Here is found the triangular apex of the lung, sometimes reaching on the right side slightly higher than on the left (more rarely *vice versa*), with portions of the subclavian and carotid arteries, and of the subclavian and jugular veins. The first rib contributes to form a sort of floor for the region.

9. *Clavicular*.—This region comprises the portion of the clavicle, behind which lung lies, or, as nearly as possible, the inner half of the bone. Behind the bone lies on both sides lung-substance; on the right side, at the sternal articulation, the arteria innominata just reaches the inner confines of the region, while the subclavian artery crosses it at its outer edge; on the left side the carotid and subclavian arteries lie deeply, almost at right angles with the bone.

WILLIAM

W22
1871

TO

RICHARD QUAIN, F.R.S.,

LATE PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,

WITH SINCERE RESPECT FOR HIS PUBLIC CAREER

AND IN

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hollow, bounded below by the notch of the sternum, and laterally by the sterno-mastoid muscles. The trachea fills it almost completely; it contains no lung; the innominate artery lies at its lower right angle; and in some persons the arch of the aorta reaches its lower border.

14. *Upper-Sternal*.—Corresponds to that portion of the sternum lying above the lower border of the third rib. Here are found the left, and a small portion of the right, innominate vein; the ascending and transverse portions of the arch of the aorta; the pulmonary artery, from its origin to its bifurcation; the aortic valves, near the lower border of the third left cartilage,—the pulmonary a little higher than these, and quite at the left edge of the sternum; and the trachea, with its bifurcation on the level of the second ribs. The inner edges of the lungs, passing slantingly downwards, almost join on the middle line opposite the same ribs, when the organs are fully expanded,—and lying immediately under the sternum, continue thus united as far as, and beyond, the lower edge of the region.

15. *Lower-Sternal*.—Corresponding to the remainder of the sternum, this region contains the main part of the right ventricle, and a small part of the left; the line of union of the heart and liver, with the diaphragm intervening; the edge of the right lung descending vertically along the middle line, and, at its upper part, a small portion of the left lung; and inferiorly, and deeply-seated, a portion of the liver, and sometimes of the stomach. The tricuspid and mitral valves, the latter somewhat posterior to the former, lie at mid-sternum opposite, or a little below, the upper edge of the region.

16. *Axillary*.—Extending from the point of the axilla above, to a line continuous with the lower border of the mammary region below, and in front from the posterior border of the infra-clavicular and mammary regions, to the external edge of the scapula behind, this region corresponds to the upper lobes of the lungs, with, deeply-seated, the main bronchi.

17. *Infra-Axillary*.—Bounded above by the axillary region, anteriorly by the infra-mammary, posteriorly by the infra-scapular, and below by the edges of the false ribs, this region contains on both sides the lower edge of the lung sloping downwards from before to behind, with, on the right side, the liver, and, on the left, the spleen and stomach.

18. *Upper Scapular and Lower Scapular*.—Have the same boundaries as the fossæ of the scapula, and correspond to lung-substance.

19. *Infra-Scapular*.—Boundaries: above, the inferior angle of the scapula and the seventh dorsal vertebra; below, the twelfth rib; outside, the posterior edge of the infra-axillary region; inside, the spine. Immediately underneath the surface, as far as the eleventh rib, lie the lungs; on the right side, the liver from the level of the rib just named, to the lower edge of the region; on the left, the intestines, occupying some of the inner part of the region, and the spleen of the outer. Close to the spine, on each side, but somewhat more on the left than the right, a small portion of the kidney encroaches on this region; and along its inner edge, on the former side, runs the descending aorta.

20. *Inter-Scapular*.—Occupying the space lying between the inner edge of the scapula and the spines of the dorsal vertebrae from the second to the sixth, this region contains on both sides lung-substance, the main bronchi, and the bronchial glands. It also encloses, on the left side, the œsophagus, and, from the third or fourth vertebra downwards, the descending aorta. The bifurcation of the trachea takes place at the middle line, between the two regions, with some inclination, however, to the right side.

METHODS OF PHYSICAL DIAGNOSIS.

21. We propose here to give a general description of the various methods of physical diagnosis, and in the case of each method shall successively examine:—Its nature: its direct or immediate object; the manner of practising it; the conditions which are discovered by its means in the healthy state; such deviations from the ordinary standard of these conditions as are, nevertheless, compatible with health; and, lastly, the deviations from that standard, which are actually morbid and constitute signs of disease.

SECTION 1.—INSPECTION.

22. By inspection of the chest, as a method of physical diagnosis, is understood simply the ocular examination of its external surface; by inspection are ascertained the conditions of exterior form and size of the cavity, and of the movements of its walls. The form of the chest is to be considered in respect of its general configuration, and the shape of its various parts. The size of the cavity is less important considered as a whole, than as composed of two divisions; the relative dimensions of these being the point of chief consequence. The movements of the chest are general and partial; the general class includes those of expansion and of

cleration; the *partial*, those of the ribs in respect of each other, and those of the *intercostal planes*.

23. In order to insure correct results from inspection of the chest, the following precautions are to be observed:—the light must be good; the surface fully exposed; the patient's muscles relaxed, and all physical restraint removed; and, above all, the plane on which he lies, stands, or sits, must be perfectly even. When the patient's state allows the observer the choice of the three postures just mentioned, the sitting ought generally to be selected. Inspection should be practised anteriorly, posteriorly, laterally, and from above downwards,—in the latter direction particularly, as a means of roughly ascertaining the antero-posterior diameter of the chest. Under all circumstances, it is of the last importance that the two sides, both generally and in their various corresponding parts, be closely *compared*. This observation applies with the same force to all other methods of physical examination; without *comparison* of corresponding regions the utility of this kind of investigation would be very materially diminished. But in order that such comparison shall not be fallacious, it is, of course, essential that the observer should be fully alive to the numerous physical differences which naturally exist in corresponding parts of the two sides.

24. A. *Form*.—(I.) *In Health*.—The form of the chest of persons who have never had any affection of the thorax itself or its contents may be *regular*, or more or less *irregular*.

25. The adult male chest if *regularly* formed, resembles, when viewed anteriorly, and exclusive of everything except its own immediate integuments, a cone, having the narrow end uppermost; its transverse diameter obviously exceeding the antero-posterior; its two sides symmetrical, both generally and in their different parts; the supra-clavicular spaces very slightly depressed; the lower sternal region hollowed out in proportion to the stoutness of the individual; the infra-clavicular regions gently convex; the costal angles, formed by the union of the false ribs and middle line anteriorly, very nearly equal,—that on the right side being slightly the more obtuse; the intercostal spaces visibly hollow both during inspiration and expiration, unless the individual be notably full in person; the lateral surfaces of the chest equally distant from the median plane,—as likewise the nipples, which are on the same level, that of the fourth rib or fourth intercostal space; and the different regions of the chest, considered in themselves, regularly shaped. Posteriorly, the shoulders lie on the same level;

the spine is either perfectly straight, or inclines very slightly to the right at mid-back; and the vertebral sulcus, moderately concave from above downwards, more or less deep according to the fatness or thinness of the individual.

26. But it is comparatively rare to find a chest having in all respects the characters now enumerated. Certain deviations of form, perfectly compatible with a healthy state, both of the thoracic organs, and of the body generally, are of extremely common occurrence. It would follow, indeed, from the investigations of M. Woillez,* that the *regularly* formed chest, just described, exists in scarcely more than twenty per cent. of adult males, taken indiscriminately. The irregularities which render the chest non-symmetrical, while themselves perfectly compatible with health, are by this author termed *physiological heteromorphisms*† the title *pathological* being applied to those that are the manifest results of disease.‡

27. It is obvious that the chief, almost the sole, clinical importance of these "physiological" departures from regular form consists in the chance of their being mistaken for alterations of shape dependent on disease. Their frequency indicates the necessity of acquaintance with them: in 197 cases, examined by M. Woillez, there existed 251 such heteromorphisms; 144 of these occurring in 111 persons who had had thoracic disease, 107 in 86 individuals who had all their lives been perfectly free from such disease.

28. Physiological heteromorphisms may be congenital or acquired, and general or partial. The *general* are those in which the natural relations of the different diameters of the chest are altered; the *partial* consist of local defects of symmetry, exercising no influence on the general shape of the thorax.

29. Again, certain local irregularities of form may be either of physiological or of pathological origin: disease may produce in one chest precisely the same alteration of shape that accidental circumstances, in no wise impairing health, effect in another. When a deviation of form, which may be thus either morbid or not, presents itself, its mode of origin can only be positively determined by the absence or presence of other signs denoting sub-

* *Essai sur le geste, sur l'inspection et la Mesuration de la Poitrine.* Paris, 1838.

† *Physiological heteromorphisms, and supra form.*

‡ *Acquired* (congenital) chests are more common before than after the age of thirty, and in persons who follow sedentary pursuits or trades requiring little muscular exertion, or who have never laboured under thoracic disease, than among persons in the opposite conditions. The prevalence of such disease does not, of course, necessarily imply the existence of irregularity of form.

jacent disease, or by the previous history of the individual showing that he has or has not suffered from pectoral complaints.

30. (II.) *In Disease.*—Alterations of form and of position of the whole thoracic surface, or of its parts, if considered in regard of *their physical characters*, may be referred to the following species:—(a) Expansion and Bulging; (β) Retraction and Depression; (γ) Procidencia and Elevation; (δ) Curvature; (ε) Distortion.

31. (a) *Expansion* signifies a change of shape of the chest, in which one or both of its sides is generally prominent; *bulging*, a local or circumscribed expansion, the remainder of the thoracic surface being either in the natural state or affected with some other species of irregularity. Expansion of one side, produced by some force acting from within outwards (the elasticity of the lung having been first destroyed), is best seen in cases of abundant pleuritic effusion, with or without pneumonia; in pneumothorax, hydropneumothorax, and general vesicular emphysema; less clearly in hypertrophy of the lung, intrathoracic tumor, and extensive hæmothorax. Simple pneumonia and hydrothorax have not yet been proved to produce it; nor are any affections of the heart or great vessels capable, even as matter of theory, of doing so. Expansion of either side is never a physiological heteromorphism.

32. *Bulging* takes place to such extent as to arch, generally, the upper anterior surface, in rare instances of tuberculous excavation;* occurs at either base in pleuritic effusion and in pleuropneumonia; in emphysema appears above and below the clavicles, and has been observed to a very slight extent in those regions in cases of simple pneumonia of the apex; exhibits itself in various sites in cases of circumscribed pleurisy and intrathoracic tumor; in the right infra-axillary region in cases of enlarged liver, and in the left of enlarged spleen; in the mammary and lower sternal regions in pericardial effusion and hypertrophy of the heart, and in the upper and central parts of the chest in cases of aortic aneurism. But on the other hand, bulging frequently occurs as a natural condition in the following positions: the right back inferiorly; the left front inferiorly, with or without twisting forwards of the free edges of the ribs; the upper sternal region; the second costal cartilages, either or both; and the left sternomammary regions. Such non-morbid bulgings simulate those produced by pericardial effusion, aneurism of the aorta, pleuritic effusion, &c.

* Sanders, V. C. H., *Males*, vol. xiv. p. 313; a huge cavity in the left lung, a small one in the right, with encroachment of the right lung on the region of the left.

43 (3) *Retraction* and *depression* are the converse states of expansion and bulging: the former, a general sinking of the walls on one side; the latter a similar condition limited to one spot or region. *Retraction* never exists without reduction of size of the lung, produced either by extrinsic pressure or by changes in its own substance. Now, pressure is essentially concerned in cases of pleuritic effusion; the lung, reduced to a small bulk by the pressure of accumulated fluid, deprived of its elasticity, and bound down by exudation-matter, is unable to resume its original volume on the removal of the fluid by absorption,—the side consequently yields inwards under the weight of the atmosphere. The exudation-matter aids materially, through its characteristic force of contraction, in producing this result, by diminishing the bulk of the lung, not, as might be supposed, by actually dragging the wall of the chest inwards. On the other hand, changes of the lung-substance, reducing its bulk, occur in tuberculous disease, the absorptive period of pneumonia, in cancerous and certain exudative infiltrations of the lung, and in collapse and atrophy of the organ consequent on the inaction entailed by pressure on its main bronchus by enlarged glands, tumor, or aneurism.* *Depression* attends the same morbid states, when more limited in extent and influence. In estimating the clinical value of depression, the observer must remember that it sometimes occurs in the lower sternal region, and, symmetrically, in the inframammary regions, independently of disease,—nay, I am persuaded, in some rare instances non-symmetrically at the left side only.

34. (7) *Proculentia* is that state in which the position of a part is lower than natural; *elevation*, that in which it is higher. Examples of *proculentia* are seen in the lowered position of the shoulder, of the ribs laterally, and of the nipple in chronic pleurisy with retraction. The shoulders are not always naturally on the same level, however; and the left nipple is, in healthy persons, frequently lower than the right. I once observed *elevation* of the shoulder on the same side as retraction of the parietes from chronic pleurisy.

35 (8) *Curvature* signifies that deviation of the various axes of a part, in which, notwithstanding, some degree of regularity of

* I once met with a remarkable case in which the girth of the right side only measured 14 inches, while the left measured 15½ inches, there being no history of past pleurisy or acute disease of the right side. Congenital atelectasis, or intra-uterine pressure, suggested themselves in explanation, but, on further examination, the whole right side, chest, back, and pelvis was found to be notably smaller than the left. The patient, a male, aged about thirty, had been a seven months child.

form is retained; *distortion*, a displacement of the same kind fundamentally, but one in which the deviations are so numerous and so considerable that all trace of regular shape is lost. The spine, sternum, clavicles, and ribs, are subject to the former of these displacements in connection with disease of the subjacent organs. Thus the dorsal spine becomes laterally curved in cases of chronic pleurisy with retraction; the ribs, in extreme cases of the same disease, undergo such torsion on their longitudinal axes, that their upper edges become external; the sternum yields sideways under the pressure of intrathoracic tumors, and the clavicle twists downwards and inwards in some cases of tuberculous destruction of the apex of the lungs. Some slight deviation of the dorsal spine to the right I have found to be more common than perfect straightness in male adults with sound chests; and the sternum sometimes naturally inclines to one side.

36. Here may be included the peculiar conformation, called "pigeon-breast," characterised by flattening of the lateral regions, and prominence, with arching forwards, of the sternum. This is doubtless a congenital malformation in some cases; but it may also be an acquired deformity. As has been satisfactorily shown by Dupuytren* and Mr. Shaw,† this alteration of form may be produced, especially in the flexible chest of childhood, by protracted difficulty of breathing, depending on obstruction in the upper air-passages. The principle of its production will be explained further on [54].

The pigeon-breast seriously perverts the natural relationship of the heart and lungs, and modifies both the heart's impulse, and the mode of conduction of its sounds.

37. *B. Size.*—No practically useful rule can be laid down respecting the ratio of the natural visible dimensions of the thorax to those of the body generally; the proportion varies widely in different individuals enjoying robust health [1036].

38. There is no *visible* inequality of size in the two sides of a well-formed thorax. Numerous deviations from the natural relative dimensions of the different parts of the thorax occur in consequence of disease; but as they are always to be more accurately estimated by measurement than by inspection, and in some cases only to be ascertained at all by means of the former, the consideration of their different varieties is deferred to the section on **MENSURATION**.

* Mémoires de Chirurgie.

† Medical Gazette, 1842.

39. C. *Chest Movements.*—(1.) *Movements in health.*—(a) The *general* movements, or those in which the entire thorax is concerned, are of *expansion* and of *elevation*. In health these two kinds of movement are so intimately associated and agree so closely in proportional amount, that it is unnecessary to consider them separately: in certain states of disease they are very differently affected.

40. During *inspiration* the walls of the chest diverge from their central axis,—the sternum and the anterior segment of the ribs passing somewhat forwards, the lateral outwards, and the posterior backwards, from that axis (*expansion-movement*). At the same time the anterior walls, and, with the exception of the three or four last ribs which are on the contrary depressed, the lateral walls also, rise upwards (*elevation-movement*). In ordinary breathing these movements are in the direct ratio of the antero-posterior and transverse enlargement of the lungs,—but not precisely so of their vertical enlargement, inasmuch as there is no constant proportion between costal and diaphragmatic movement. The rapidity, the energy, and the extent of the expansion and elevation-movements, bear a direct proportion to each other under all circumstances of health, unless volition interfere to pervert the natural order of things. On the other hand, the absolute amount of all three characters varies within sufficiently wide limits in different persons,—but is found to increase, as a rule, in the direct ratio of the easy mobility of the frame-work of the chest (hence greater in youth than age), and the height of the individual.

41. During *expiration* the walls of the chest are restored to their previous condition by the converse movements of *retraction* and *depression*.

42. In each act of respiration the movements of expiration follow those of inspiration so closely, that no distinct pause is perceptible between them; when expansion and elevation cease, retraction and depression appear to begin, precisely as the audible pulmonary sounds by which they are accompanied.

43. The *rate of motion*, though this be free from all jerking inequality of rhythm, differs perceptibly at different periods of the two acts: inspiration-movement begins slowly, quickens, slackens again, expiration-movement starts off rapidly, gradually slackening to its close.

44. If the entire time occupied by a respiratory act (that is, from the beginning of one inspiration to the beginning of the next) be represented by 10, the value of the visible duration of

the inspiratory movement may be estimated approximately at 5, of the expiratory at 4, and of the pause between the expiratory and succeeding inspiratory movement at 1;—the period of thoracic motion being to that of rest, as 9 : 1. The motion at the close of expiration is so small in amount, and so slowly effected, that it is very difficult to fix accurately the instant at which the actual rest, dividing any two succeeding respiratory acts, commences; however, the ratio just given furnishes the mean of a number of observations, from which very extreme and apparently exceptional results were excluded: they were made by watching the movements of a small flat board, laid on either the superior thoracic or the lower thoracic and abdominal regions, according to the sex of the individual [49].

The ratio indicated only holds in calm breathing; when respiration is hurried, the inspiratory act loses in relative duration: the easier the breathing, the longer the interval (in some individuals peculiarly so) between the end of expiration and the next inspiration. No observation can be trusted to, which is derived from the movements over a very limited area of surface.

45. In health, the *extent* and *frequency of repetition* of the movements of the thorax are in the direct ratio of the *duration* and *intensity* of the pulmonary respiration-sounds.

46. (b) The *partial movements* of the ribs on each other,—movements, practically speaking, limited to special situations,—are best appreciated by application of the hand.

47. In perfectly calm breathing the intercostal spaces continue visibly hollow, both during inspiration and expiration,—more so, during the former than the latter act. In the male this is most obvious in the infra-axillary regions; in the female in the infra-clavicular: in both sexes the fact is of course ascertainable with an amount of ease in the direct ratio of the thinness of the individual. In forced breathing the deepening of the interspaces is still more marked in inspiration; whereas during expiration they become more or less perfectly flat.

Further, the post-sternal hollow, and the supra-clavicular regions, seem to sink slightly inwards in calm inspiration, filling out again in expiration.

48. *Abdominal Movements*.—But the movements of the walls of the chest are not the only ones which are of clinical importance. The enlargement of the lungs and descent of the diaphragm in inspiration, forces down the subjacent viscera, and causes protrusion of the abdominal walls, especially anteriorly; during

expiration these walls recede. Hence in *ordinary* or *calm* breathing, which is mainly effected by the descent of the arch of the diaphragm, the amount of abdominal is greater than that of thoracic expansion-movement, and the former commences sensibly before the latter.

49. There is a striking difference, however, in this point of view, between the sexes; and the statement just made applies in point of fact to the calm breathing of the male only. In the female the abdominal expansion is almost null, and always slightly posterior in time to the upper costal; neither do the lower ribs move notably; whereas the clavicles and infra-clavicular regions rise and fall with freedom. The adult male seems to the eye to breathe with the abdomen and the lower ribs from about the tenth to the sixth; the adult female with the upper third of the chest alone.

50. The cause of this difference in the sexes is not satisfactorily determined. It is yet a point *sub judice* whether, and to what proportional extent, the discrepancy of adult life prevails in infancy and early youth. I have examined a considerable number of female children, aged between four and ten years, who had never worn stays, or any substitute for these, and found in them the predominant infra-clavicular action of the adult. But the excess of upper movement is very positively less than among their seniors. On the other hand, Boerhaave (*Prælect. Academ.* § 623. tom. v. p. 144. Ed. Haller, Amst. 1744), one of the earliest observers of the difference in the respiratory action of the sexes, speaks as though the boy and girl of "one year old" breathe as distinctively, the one with the abdomen, the other with the chest, as the full grown man and woman. *Per contra*, Beau and Maissiat affirm, that in earliest infancy, and often up to the third year, the respiration is abdominal in the female as well as in the male. It has appeared to me positive, that in earliest youth, when the pectoral and ventral modes of breathing first became obvious, the chest action in the female is more *general*, and less limited to the upper regions, than at a later period. *Age*, then, does seem to me to exercise an influence upon, or to be connected with, the typical breathing of the sexes.

Social position (irrespective of dress) has no modifying power; the washerwoman and the peeress breathe exactly alike.

The *habit of forced breathing* is not without its effect on the calm action of both sexes. For instance, the extensive play of the upper regions in full-chested *soprani*, kept up in the exercise

of their art for many hours daily, ends by increasing the amount of infra-clavicular movement in ordinary conversational breathing. It has appeared to me that, even in *tenor* singers, some perversion of the ordinary condition—some degree of unnatural infra-clavicular movement—may be detected in calm respiration.

But what influence does *dress* exercise? Looking at an adult female, and remembering her habit of drawing in the lower ribs by apparatus more or less unyielding, the inference would seem unavoidable that the reason why a woman does not breathe like a man is, that her mode of dress mechanically obstructs phrenic play. Certain mischiefs entailed by tight lacing we see positively in displacement of the liver;—in mis-shapement of it, so that its height may be made to equal, nay to exceed, its breadth;—in alterations of its texture, so that true lobular substance is replaced to a greater or less depth by induration-matter functionally useless. We see them exhibited in displacement of the heart;—in narrowing of the lower intercostal spaces, &c. And if, from certain of the facts concerning age, just passed in review, we are forced to the admission, that the activity of infra-clavicular respiration-movement in the female is in the main designed by nature, and independent of extraneous influence, still I cannot help thinking that the great excess of that movement, and the limitation of breathing play to the upper thorax in the civilised adult female, are due in no small measure to the use of unyielding cases interfering with inferior costal and phrenic action. The agricultural female labourer, who knows not stays, breathes more like a male than the town-bred female. Besides, during sleep, the conditions of pectoral and ventral action in the female are much less strikingly different from those in the male than in the waking state; the waist is relieved for a time from constriction. And further, the male and female dog breathe almost exactly alike, as do also the horse and mare; the action is abdominal and lower costal.

51. It would seem then that stays are in part productive of the peculiarity of adult female breathing, but certainly are not its sole cause. Boerhaave, and his commentator, Haller, however, holding that the total sexual difference obtains from birth, looked upon the free upper costal action in the female as a pre-ordination to meet the difficulties of pregnancy. "*Nisi hanc,*" says Boerhaave, "*in foemina diversitatem natura fecisset, gravidæ perpetuâ dyspnœâ laboravissent, æque ac viri hydropici.*" But it seems here to be forgotten, that if the illustration be sound, ascitic females ought to escape dyspnœa. The final cause of the difference in the sexes

is of less interest, however, than the mechanism by which it is actually worked out; but of this also nothing is known. Haller ascribes the predominant costal action in females to the greater flexibility of their bones and cartilages (Op. Cit. pp. 98, 145). The upper interspaces are relatively wider in the female, the lower in the male; but is this effect, or cause, or neither one nor the other? A most singular fact (if fact it actually be) is that, according to the assertion of Kuchenmeister, Fabius, and F. Arnold, the enlargement of the uterus in pregnancy exercises no influence on the "breathing capacity" of the individual.

52. But whatever be its cause, this sexual difference disappears in *forced* breathing; in both sexes the pectoral movement is, out of all proportion, greater than the abdominal; and even in the male the expansile action, if abrupt, commences superiorly.

53. Various postures, which interfere with action in limited parts of the chest or abdomen, throw extra-work on others, and so alter the mechanism of respiration. Thus, in calm breathing, the male, when lying on one side, exhibits extra-costo-abdominal movement on the other; in the supine posture there is no perceptible movement in the perinaum, while in lateral decubency sufficient rise and fall takes place there to count the respirations by.

54. (II.) *Movements in disease.*—(a) The general movements of simultaneous expansion and elevation are liable to *diminution*, either from consensual avoidance of pain, paralysis of the muscles concerned in producing them, or a material obstacle in the condition of the pleura or lung. Thus in pleurodynia, intercostal neuralgia, and at the onset of pleurisy, the first cause acts; in cerebral and in spinal paralysis, the second; while in cases of pneumo-thorax, pleurisy, and pneumonia, of obstruction of the main bronchus, of gaseous, liquid, or solid accumulation in the pleura, of consolidation and rarefaction of the lungs, the third proves the efficient agent.

(On the other hand, these movements *exceed* the healthy standard, where a muscular effort is made to overcome some obstruction, seated *low* in the chest, as in spasmodic asthma, and especially if the diaphragm be mechanically interfered with, as in pericarditis with copious effusion.

Or they may be *perverted*: if the *upper* air passages be obstructed, either from disease in themselves (oedema of the glottis; laryngitis, simple, oedematous, or croupal; tumors; foreign bodies, &c.) or in neighbouring parts (enlarged tonsils; pharyngeal

disease,* &c.), or from spasm of the glottis (as in epilepsy, hysteria,† laryngismus stridulus, pertussis and chorea), the chest, instead of expanding during inspiration, will actually retract, especially below and at the sides, while the abdomen enlarges, from descent of the diaphragm, in proportion to the amount of obstruction. In many of these affections the rhythm of the movements becomes jerking and uneven. The more flexible and expansile any given chest is in health, the more marked will be this perversion, where obstruction exists above the bifurcation of the trachea: it attains its maximum consequently in childhood. The explanation is easy. The small quantity of air inspired makes naturally to the nearest air tubes, those of the upper lobes, while none reaches the lower, though fall of the diaphragm has prepared these for its reception; the lower lobes collapse, and the inferior parts of the chest are consequently driven inwards by atmospheric pressure. This state of things becomes permanent where its cause is permanent; and thus is engendered in some cases the so-called pigeon-breast [36]. Instead of this bilateral perversion, the phenomenon will be unilateral, and flattening of one side, with lateral curvature of the dorsal spine, having its convexity towards the healthy side, ensue, if the obstruction affect the main bronchus on one side only; or it will be still more limited if a bronchus of second or third calibre be alone affected. Now, whenever any cause seriously impairs the expansion-movement of one side only, the expansion of the other is liable to increase; and similar deficiency of action, limited to a part of one side may be made up by excess on the rest of that side: the law is the same as for the audible phenomena of respiration. It holds good, too, where the obstruction is parietal, as in general cancerous infiltration of the wall of either side of the thorax.‡

55. Want of power in the respiratory muscles, whether from debility or from paralysis, will impair the chest-motions, and entail flattening of the corresponding side.§

* Constable, U. C. H., Females, vol. ix. p. 97. Cancerous ulcerated opening between œsophagus and trachea. Two days before death, base of chest expanded, the apices sank in, in inspiration. Yet the apices proved to be sound, the bases congested.

† Spenser, U. C. H., Females, vol. ii. p. 147, Jan. 1847.

‡ I have seen the chest wall so fixed by infiltrated scirrhus, that the strongest effort of the will failed in producing any appreciable expansion of the affected side.

§ The experiments of Stromeyer ("Ueber paralysis der Inspirations Muskeln, Casper's Wochen-schrift, 18. 7.") show that the division of the posterior thoracic nerve in the rabbit will suffice to reduce the measurement of the corresponding side of the thorax by five or six lines in less than three weeks.

56. In the tetanic spasm, whether from disease or from strychnia, the walls are fixed.

57. *b.* The relation of the movement of expansion to that of elevation may change completely; the former, for example, being almost totally suppressed, while the latter becomes even peculiarly obvious. When the lung-substance is more or less impermeable, either locally or generally, and either from disease within itself or pressure from without (as in cases of tubercle, pneumonia, pleurisy, pleuritic and pericardial adhesion, intra-thoracic tumors or aneurism), this kind of perversion in movement will exist, either locally or generally, according to its cause. It is especially marked in forced inspiration; volition may drag the thorax upwards, but cannot expand impermeable texture. In vesicular emphysema, while the elevation-movements are carried to an extreme point, there may be no expansion at all (nay even slight retraction at the base) during inspiration.

58. *c.* The rhythm of the respiratory act is likewise subject to change: the duration of the expiratory movement may become considerably greater than that of the inspiratory. This is observed whenever physical obstruction exists in any part of the passages, from the nares downwards, to the exit of air from the lungs; and also where, as in vesicular emphysema, the elasticity of the lung is destroyed. In the latter affection the expiratory movement may be two-and-a-half times as long as the inspiratory.

59. *d.* The proportion naturally subsisting between the extent and frequency of the movement of elevation on the one hand, and the duration and intensity of the respiration-sounds on the other, may be altogether perverted: the former may be greatly increased in amount, while the latter have undergone remarkable diminution. This state of things constitutes one of the most remarkable features of diseases, where spasm affects the bronchial tubes or glottis, and obstructions of physical character exist in the larynx, trachea, or larger bronchi. The inspiratory action is abrupt and short, the expiratory prolonged.

60. *e.* Again, the relationship of the thoracic and abdominal movements may change completely. Thus all conditions interfering, either dynamically or statically, with the movements of the diaphragm, while they impair these, give excess of energy to the thoracic class. Inflammation of the diaphragm, or of the serous membranes covering it, great fluid effusion in the pericardium, solid, fluid, and gaseous accumulations in the abdomen, pervert in this manner the natural order of things. On the other hand, the diaphragmatic

movements may be increased by certain irritations of the phrenic nerves, in pleurodynia, intercostal neuralgia, the painful periods of pleurisy, in diseases or injury of the spinal cord below the phrenic nerves,—and, when compared with the amount of expansion-movement of the thorax, in obstructive diseases, functional or mechanical, of the air passages.

Not only may the relative force and amount of these two classes of movement be thus altered, but, as was first significantly shown by M. Duchenne, one of them at least may lose its natural position in point of time in the respiration-act. He has proved both experimentally and clinically that in all cases of marked impairment of power, or downright paralysis of the diaphragm, the abdominal bulging, naturally occurring in inspiration, is transferred to expiration, while conversely the upper abdominal wall sinks in during inspiration.

61. (*f*) *State of the costal angles.*—In the natural state the costal angles are nearly equal,—the left being slightly the more acute of the two. All affections, contracting either side of the chest to the exclusion of the other, increase the acuteness of the costal angle on the former,—as chronic tuberculation, chronic pneumonia, chronic pleurisy with retracted side, cirrhosis, &c. All affections augmenting the positive bulk of either lung widen the costal angle on the affected side,—as rapid and general hepatisation, and acute general tuberculous infiltration.* The more fully the base of the lung is implicated in the disease, the more obvious will be the effect. Where the costal angle is narrowed, its costal limb is depressed; where the former is widened, the latter is raised.

62. (*g*) In estimating the thoracic movement of calm breathing in disease, the sex of the patient must always be borne in mind. An amount of infra-clavicular expansion, ample for a male, would be below par for a female: the converse is true of infra-axillary action. Various morbid states pervert the natural sexual condition,—giving the female the free lower action of the male thorax, the male the upper mobility of the female thorax.†

* Hudson, *U. C. H.*, Males, vol. ix. p. 17. In this case of combined acute tuberculation and pneumonia, while increase of bulk existed inferiorly, diminution by interstitial contraction had set in superiorly.

† I have seen this in *Cholera Asiatica*. Cotton, *U. C. H.*, Males, vol. xi. pp. 57, 58, ætatis 17. During the algidæ period this lad breathed costally and superiorly, exactly as a woman; two days later, the choleraic hæm having disappeared, the breathing had become abdominal and inferior costal. The perversion is evidently connected with collapse of the lungs.

63. (*h*, *Variations of the inter-costal spaces*: (*a*) *Statical*.—The intercostal spaces are widened by fluid and gaseous collections in the pleura, by intra-thoracic tumors and aneurism,—by certain kinds of enlargement of the heart, by hydropericarditis,—by extensive plastic infiltration of the lung, when sudden and in the acute state. Fluid in the pleura or pericardium may, in addition, cause actual bulging of the intercostal planes, irrespectively of the nature of that fluid, whether purulent, serous, or bloody. It has been commonly taught that bulging attends purulent accumulation only, and may hence be considered diagnostic of the nature of the fluid. I am satisfied this is an error. The real cause of the arching outwards of the muscular planes is paralysis from inflammation,—and hence, though very probably the occurrence is more common when the fluid is purulent, it is theoretically producible (as experience proves to be the fact) when the fluid is sero-albuminous.

64. The interspaces undergo narrowing in the absorption-period of pleurisy and pericarditis, and in all affections causing marked contraction of the lungs.

65. (*β*) *Dynamic*.—The normal respiration-movement of the intercostal planes may, in disease, be diminished, annulled, increased, or perverted.

66. During the painful periods of pleurisy, in pleurodynia, in intercostal neuralgia, in herpes zoster of the chest-wall, the action of the intercostal muscles is controlled, nay suspended sometimes, by so-called consensualism. In hemiplegia the action may be very slight. So far the mechanism is nervous: but mechanical interference may be caused by solid masses distending the side of the thorax,—and by fluid accumulations, provided they be sufficiently copious to entail bulging of the interspaces.* Quantity of fluid is, however, not the only element to be considered,—for accumulation sufficiently great to destroy pulmonary percussion-tone up to the spine of the scapula (and consequently to compress the lung seriously), will not put a complete stop to intercostal action. Nay more, under such circumstances the movement may be actually greater in the infra-axillary spaces on the diseased than the healthy side. On this point I am anxious to insist most strongly, as it both seems paradoxical, and clashes with commonly received

* Mediastinal tumour, with solid infiltration of the lung, will not annul intercostal movement, even though the lung adhere to the side, unless a distending influence be exercised on the chest-wall by the mass.

notions. In pneumothorax, too, with very notable bulging, the superjacent interspaces may play freely.*

Increase of intercostal movement takes place in the paroxysm of spasmodic asthma.

The intercostal movements are liable also to perversion: the spaces may bulge beyond the level of the ribs during expiration; they may bulge too in inspiration: and this in different parts of the same chest at once tuberculous and emphysematous.

67. If fluid be accumulated in sufficient quantity in the pleural sac to cause marked bulging of the weakened muscular planes, an undulatory movement caused by respiration may sometimes be seen. If, in addition, the pleura and muscular layer be perforated, and a fluid collection in the walls of the thorax communicate at all freely with another in the pleural sac, an inspiratory fall and an expiratory rise of the interspace become distinctly visible.

SECTION II.—APPLICATION OF THE HAND.

68. By application of the hand and palpation, are meant the acts of laying the hand on, and feeling, the external surface of the chest. The object of these acts is to ascertain the *form* of the different regions of the thorax (little or no information can be derived from them regarding the *general* conformation of the cavity); the state of the *general*, and especially of the *partial*, *movements* of the walls; the amount of *vibration* communicated to the hand from those walls, the existence or absence of *fluctuation* within the chest, and the *frequency* of *respiration*.

69. In employing this method of diagnosis, the palmar surface of the fingers and hand should be laid gently and evenly on the surface. If the object be to investigate the form or movements of the thorax, this is the only precaution, in addition to those recommended for the proper performance of inspection, which it is necessary to observe; if the thoracic vibration be the subject of examination, it is advisable to place the patient in the horizontal posture on some freely vibratile material.

70. (I.) *Thoracic Movements*.—Application of the hand is less useful than inspection in ascertaining the amount of *general movement*, taken as a whole, existing in any given thorax; but it is greatly more effectual in *locally* distinguishing *expansion* from *elevation*-movement, and in analysing the *partial* costal movements.

* Reilly, U. C. H., *Males*, vol. xvi p. 168. Intercostal action as great on the side of the pneumothorax as on the healthy side.

Thus in chronic pleurisy with retracted side a good deal of elevation-movement may be felt during inspiration, while the total absence of any action tending to fill out or expand the hand laid on the surface is readily ascertained. The same state of things may constantly be established in the infra-clavicular regions, when the apex of the lung is consolidated. In this case, and also in empyema, the thoracic walls, above and below the clavicle, may fall in during inspiration and expand during expiration, while the elevation-movement pursues its natural course and rhythm.

71. In the normal state, calm inspiration causes divergence of the lower ribs, and convergence (as originally shown by Haller, and recently by Dr. Sibson) of the upper; while an intermediate set from the fourth to the seventh, undergoes scarcely any change of relative position. Expiration produces the converse effects. The amount of alteration is greatest superiorly in women, inferiorly in men; and in both sexes greater anteriorly and laterally than posteriorly. Forced breathing widens and narrows the interspaces proportionately more; the convergence of the infra-axillary ribs in the male during extreme expiration is particularly remarkable.

In the lower interspaces of the male, it is easy enough, by placing the thumb or a finger on their surface, to appreciate and roughly estimate the amount of these movements. But it is very difficult to detect the inspiratory convergence in the upper spaces. When a finger is placed in an upper intercostal space, and the thinner the subject of the observation the better, it seems to be compressed by the adjacent ribs during expiration, and relieved of all pressure during inspiration—just, though not to the same amount, as in the lower interspaces. There is, however, some fallacy in the manner of making the observation; for I have found, by performing artificial respiration, after the removal of the integuments, on the dead male subject, that the upper ribs do actually converge during that movement. The amount of approximation, even in persons with wide intercostal spaces, appears to me not to exceed one-sixteenth or one-twelfth of an inch at the outer edge of the costal cartilages.*

72. Allied in mechanism to the expansion-movements, these

* In H. Young, *etat* 40 cartilages of lungs and decreased distal, U. C. H., *Female*, vol. vi, p. 120: approximation of the second and third left cartilages was noticed on full inspiration. The left lung was healthy, weighing 15.75 oz., but there were old general adhesions. Also case of Moore, U. C. H., *Males*, vol. vii, p. 292.

diverging-movements may nevertheless be affected differently from the former in disease. Thus, in cases of chronic pleurisy, with contracted side, the elevation-movement may, during inspiration, be still perceptible in the infra-axillary region, and the expansion-movement be absolutely null, while the ribs actually converge. This inspiratory convergence of the lower ribs has appeared to me indicative of subjacent pulmonary consolidation and pleuritic *agglutination* combined.

73. (11.) *Thoracic vibration, or fremitus.* (a) *Vocal:* (1) *In health.*—If the hand be applied to the surface of the chest of a healthy individual, while speaking, a vibratile tremor is perceived by the fingers. This vibration, delicate under all circumstances and readily deadened by too forcible pressure of the hand, is, generally speaking, in the direct ratio of the graveness, coarseness of quality, and loudness of the speaking voice, and hence, as a rule, more marked in adults than in children, in males than in females. It is often altogether deficient, indeed, in females and children. *Ceteris paribus* it is more intense in long-chested than in short-chested persons; and markedly so in thin than in fat people; unless as deepening the voice and either lessening or increasing fullness of person, age appears to have no influence upon its amount. The vibration is scarcely affected by tension or relaxation of the muscles over which the hand is laid; in the great majority of cases it is stronger in recumbency than in the sitting posture (in twenty-two trials, sixteen times greater lying than sitting, four times equal, twice more marked in the sitting than the lying posture). It is greatly more marked when some sounds are uttered than others, and hence the importance, in delicate comparative trials, of making the patient not only repeat the same word or words, but if possible intone on the same note.*

The intensity of fremitus, all conditions being favourable to its production, may be such as to throw a large arm-chair or sofa, against which the speaker leans, into strong co-vibration.

74. As a general truth, the intensity of the fremitus is considerably greater on the right side of the chest than the left,—the greatest amount of this excess existing in the infra-clavicular,

* In singing, the fremitus is much more marked when the voice is bass, baritone, or contralto, than when tenor or soprano, and it accompanies the lower notes of any given register to a much greater amount than the upper; it may be absolutely null on a high note, though most loudly sounded, while it is well marked with a low note of the same voice softly uttered. From a few trials I find that the fremitus ceases with soprano and mezzo-soprano voices between *f* and *a* on the *F* line. Baritone voices either retain the fremitus through their whole register, or lose it about their upper *f*. The supra-laryngeal register of all voices is without fremitus.

infra-scapular, and inter-scapular regions. Exceptional regions are the right infra-axillary and infra-mammary, where the presence of the liver interrupts the vibrations, and throws into comparative prominence the naturally weak fremitus in the corresponding regions on the left side: the difference would be greater, were it not for the presence of the spleen in the latter position. Where the heart is uncovered by the lung, vibration is totally absent, and the right edge of that space may be traced by its abrupt cessation there; but over the left lung there is naturally so little vibration, that modifications of the sign can scarcely be used with confidence for making out the left edge of the space. The lower border of the right lung may be traced by the abrupt cessation of all fremitus immediately below it.

The fremitus is intensely marked over the larynx and trachea, stronger at the sternal than the humeral halves of the infra-clavicular regions, generally faintly manifest on the right clavicle, and imperceptible at the top of the sternum.

75. (2) *In disease.*—The natural vocal fremitus is susceptible, *in disease*, of *increase* or *diminution*. As in the case of other signs, the existing amount of change is most effectually ascertained by comparison of the two sides of the chest; but in making this comparison, the observer must carefully bear in mind the great differences naturally existing on these two sides.

76. Unnatural density of the pulmonary texture, produced by solid infiltration, *unless this be carried to an extreme amount*, intensifies vocal vibration,—as in tuberculous or plastic infiltration, acute or chronic: pneumonia of the left base posteriorly will thus raise the fremitus above the standard of the right base in health.* Pulmonary apoplexy and oedema act, within my experience, in the same way, but to a slight amount. In dilatation of the bronchi the increased calibre of the vibrating tubes, as well as adjacent consolidation, commonly tend to the same result. In pleuritic effusion occupying the lower part of the side, the infra-clavicular region may furnish fremitus in excess.

77. When the lung-substance is removed to a distance from the chest-wall by gaseous or liquid accumulation in the pleura, as in pneumo-thorax and in pleural effusions, dropsical, hæmorrhagic, or inflammatory, the fremitus is, as a rule, annulled. Unfortunately, however, the fremitus is, in some cases, retained at the

* In cases of universal and very dense acute tuberculous infiltration the fremitus may be strong superiorly near the large tubes, less distinct inferiorly. Hodson, U. C. H., *Males*, vol. ix. p. 17.

right posterior base, even when a considerable amount of fluid exists in the pleura. Sometimes explicable by solid adhesions conveying the vibrations from the lung to the chest wall, in other instances the anomaly does not admit of explanation. The theories of unison-resonance, echo, and consonance [433], do not fairly meet the difficulty. The influence of solid accumulation, either in the lung or pleura, varies according to circumstances: *very extensive* lung-infiltration, whether fibrino-plastic, caseous, pseudo-fibrous, carcinomatous, or other, deadens the vibration, especially if the infiltrated parts be distant from the larger bronchi, and the voice feeble: * extra-pulmonary tumors and aneurisms produce the same effect. But if the other circumstances, such as the strength and graveness of the voice, be favourable, aneurisms, tumors, and cancerous infiltrations will not, even when of tolerable size, annihilate fremitus, if they be in close connection with the larger bronchi. It is commonly said that in vesicular emphysema the vibration is impaired: I have not found this habitual, and in some cases its intensity is above the range of health. Neither do I believe, as has been affirmed, that plugging of the bronchial tubes with muco-pus deadens fremitus; during the closing hours of senile asphyxiating bronchitis, the chest-wall may vibrate forcibly, both with voice and cough.

78. Vocal fremitus and audible vocal resonance bear no uniform relationship to each other, either in health or disease: for though, when the voice is grave, and low notes are sounded, they both increase and decrease equably, under the converse circumstances audible resonance may be powerful, while the fremitus is feeble or null.

As a general rule, sounds of high pitch give *relatively* most audible resonance, sounds of low pitch most fremitus. But the exceptions to this rule in the acoustics of the chest are numerous. An individual with gruff voice of low register, may have powerful bronchophony in a spot where the fremitus is next to null; † *a fortiori* may this be the case, if the voice be high-pitched.

79. (β) *Tussive*.—The act of coughing produces a vibration similar to, but less marked than, the vocal. This vibration (*tussive fremitus*) suffers the same kinds of modification in disease; but is valueless clinically, unless in cases of aphonia.

* Jennings, U. C. H., Females, vol. xv. p. 65. Med. adn. cancer encroaching on and infiltrating right lung,—in the right axilla, the fremitus null,—at the left front well marked.

† Crowhurst (right pleuritic effusion), U. C. H., Males, vol. ix. p. 143.

80. (γ) *Rhonchal*.—Certain rhonchi throw the bronchial tubes into vibration sufficiently strong to be felt on the surface of the chest (*rhonchal fremitus*); the sibilant, sonorous, and mucous, have all this property. The cavernous rhonchus, produced in excavations of the lung near the surface, may be accompanied with marked fremitus, and without fluctuation being perceptible to the finger. Stridulous respiration even, such as that attending aneurismal pressure on the trachea, may produce very distinct fremitus, greater in inspiration than in expiration.

81. (δ) *Friction*.—In the natural state of the pleura, the gliding motion of its costal and pulmonary laminae upon each other gives rise to no vibration perceptible by the hand applied to the surface. Nor is it usual, even in cases where audible friction-phenomena exist, to discover such vibration: in some instances, however, it may be detected; and the sensation conveyed (*friction fremitus*), though distinctly somewhat vibratile, nevertheless possesses more of a simply rubbing character, just as might be anticipated from a consideration of its cause,—the collision of plastic matter on the pleural surfaces. In point of intensity it varies greatly; in some cases perceptible, even in ordinary breathing, to the patient himself,—in others it is only evolved by forced inspiration, and only to be caught occasionally. Accompanying either the inspiration or expiration-movement, it is more commonly associated with the former. I have met with it to a higher degree at the absorption-period, than at the outset, of pleurisy.

82. (ε) *Pulsatile*.—A pulsatile movement of the lung, attended with a quasi-tremor on the surface of the chest, and synchronous with the systole of the heart, has been noticed, originally by Dr. Graves, in some rare instances of pneumonia and intra-thoracic cancer. Here, too, may be included the impulse of intra-pleural pulsating empyema [570].

83. (III) *Thoracic Fluctuation*.—Palpation may also be used for the detection of fluids contained either in the lungs or pleura. The sensation is that of ordinary fluctuation, commonly attended with a certain degree of vibratile tremor. Its existence may be ascertained, either by the movements of the fingers used by surgeons for detecting fluid in an abscess (*simple fluctuation*); or succussion of the chest may be required (*fluctuation by succussion*); or percussion of the surface be necessary to produce it (*"periphrastic" fluctuation*); or it may occur through the influence of respiration as an attendant on cavernous rhonchi (*rhonchal fluctuation*): in this latter case vibration may be more distinctly

felt than in the others. The "peripheric" species, described by Dr. C. Tarral, is to be detected by giving a quick sharp fillip in an intercostal space, perpendicular to the surface, when a sensation of fluctuation will be transmitted to a finger of the other hand firmly applied to the surface in the same space, at a short distance from the point percussed.* Simple fluctuation is producible, where the intercostal spaces are much bulged out by pleuritic effusion; peripheric fluctuation in the same cases, but most perfectly where air and fluid co-exist in the pleura; fluctuation by succussion in cases of hydro-pneumo-thorax and of large excavation in the lung.

As a general rule peripheric fluctuation is a sign of but little utility in clinical practice: occasionally on the contrary an intricate combination of diseased states may be satisfactorily made out, not only by its aid, but solely by its aid. Thus, in a case of association of intrathoracic cancer and pleural effusion, where it would have been impossible on other grounds to affirm or deny the presence of fluid, the detection of this physical sign at once set the point at rest.†

84. (IV.) *Frequency of Respiration*.—Application of the hand to the surface, below the clavicles in the female, below the epigastrium in the male, is the readiest way of ascertaining the frequency of respiration.

85. The absolute frequency of respiration in health averages in the waking adult twenty per minute; greatest at birth, it decreases quinquennially to the age of thirty, and between this period and the fiftieth year again increases somewhat.‡ Respiration is slightly increased in frequency by fullness of the stomach; the act is less frequent in the male than the female, and in both sexes in the lying than in the sitting, and in the sitting than in the standing postures.

86. In disease the absolute frequency may rise to eighty, and even upwards, and, wholly excluding moribund persons, may fall to eight.

87. The ratio of the respiration to the pulse is more important, in pulmonary diagnosis, than the absolute frequency of either. In the adult the natural ratio lies between 1 : 4 and 1 : 4·5. The less frequent the pulse absolutely, the higher the ratio of the respiration; a pulse of sixty will relatively give a larger number

* Sometimes a more satisfactory result may be obtained by striking the ribs.

† Seannell, U. C. H., Males, vol. xvii. p. 276.

‡ Quetelet. Sur l'Homme, t. ii. p. 91, 1836.

of respirations, than one of eighty. The influence of posture is relatively greater on respiration than on the pulse; hence the ratio varies in the same individual in the three chief postures.

88. In disease the pulse-respiration ratio is subject to remarkable perversions, which are sometimes of signal use in diagnosis. The extreme ratios which have fallen under my own notice are pulse to respiration as 9 : 1 in chorea,* and as 1 : 1.25 in pneumonia.† These perversions may be maintained, whether the pulse be, absolutely considered, frequent or not. In hysteria I have known the ratio range from 5 : 1 to 1.8 : 1.

SECTION III.—MENSURATION.

89. The object of measuring the chest is twofold: First, to ascertain, more accurately than can be done by inspection and application of the hand, the comparative bulk of the two sides, the relative positions of their different parts, and in some few instances, the distances between those parts and certain fixed points beyond the limits of the thorax (*measurements in rest*): Secondly, to estimate with precision the amount of expansion and retraction of the chest accompanying inspiration and expiration (*measurements in motion*).

§ I.—MENSURATION IN REST.

90. A complete system of Mensuration in rest, would comprise the following admeasurements:—

A. GENERAL.—(a) Circular. 1. *On the level of the sixth cartilage*; 2. *Midway between the nipples and clavicles*. (b) Transverse. 3. *From the point of one acromion to that of the other*; 4. *In the axillæ*; 5. *At the base of the chest*. (c) Antero-posterior. 6. *Under the clavicles*; 7. *At the base of the chest*. (d) Vertical. 8. *From the clavicle to the most dependent point of ribs*.

B. PARTIAL.—(a) Horizontal. 1. *From the nipple to the middle line of the sternum*. (b) Vertical. 2. *From the middle of the sternal notch to the nipple*; 3. *From the nipple to the antero-superior spine of the ileum*; 4. *From the most dependent point of the twelfth rib to the same spine*.

91. But these different kinds of measurement are not all of equal

* Case of Carpenter, *Chin. Med.*, loc. cit., *Lancet*, January, 1849.

† Stiles, *Trans. C. H. Med. Soc.*, vol. x, p. 396, on the 12th day of left pneumonia. P. = 56, heart same, respiration 50 to 50, twice counted, no subjective sense of dyspnoea.

importance, especially in the present state of knowledge,—either because some of them really convey information of very secondary value, or because they have not as yet been sufficiently practised to render the physician familiar with the indications derivable from them. The measurements which it is of real consequence for the student to understand, and in all doubtful cases to practise, are distinguished by italics: at the same time, it would be a mistake to imagine that all the others may not occasionally furnish more or less useful information, either confirmatory or corrective of results otherwise obtained.

92. A. GENERAL MEASUREMENTS.—(a) *Circular, (1) on the level of the sixth costo-sternal joint.*—Circular measurement of the chest, as commonly performed with a *single* graduated tape passed round the thorax from the middle line anteriorly, is a troublesome process, requiring the patient to be raised to the sitting posture, and the co-operation of two persons. Besides the difficulty of ascertaining the precise point of the measure, corresponding to the spine, renders the process inaccurate. These difficulties have been removed by a very simple plan, suggested, I believe, by Dr. Hare, —that of joining together *two* such tapes at the commencement of their scales, and fixing them, as the patient reclines, at their line of union, to the spine: each side of the chest has thus its separate measure. By padding the inner surface of both measures, close to their line of junction, a sort of saddle is made, which readily fixes itself to the spinous processes.

93. The circular width of the chest varies so widely in healthy individuals, that there is little practical utility in attempting to fix its mean value. I have known it in the adult male of about five foot nine inches in stature, so high, on the level of the sixth cartilage, as forty-four inches, and so low as twenty-seven [1036]. Perhaps thirty-three inches may be named as the fairest adult average; but the width varies with age, long after the height has become stationary, gradually increasing from the age of sixteen to sixty: so that the mean being thirty inches from the age of sixteen to twenty, it is thirty-four from that of fifty-one to sixty. The circumference increases, but not in any fixed proportion, with the robustness, stoutness, and height of individuals. The female circumference is, absolutely and relatively, less than the male.

94. According to M. Woillez, the circumference is greatest in persons following trades that require active exertion of the whole frame, but not of the upper extremities in particular. Far from

this, were his number of cases sufficient for the final decision of the question, the latter class of artisans must be held to have the lowest average circumference of thorax. But the absolute measurement is of less importance than might appear, for width is not an index of expansile power; on the contrary, the statical and dynamical conditions may, in fat people especially, be inversely as each other.

95. The relationship of pectoral to abdominal circumference varies with age: in infancy and childhood the latter is greater than the former. In the young male adult (less so in the female) the chest exceeds the abdomen in width. In cases of abdominal obesity the natural ratio becomes perverted.

96. Certain definite relationships exist between the girth of the chest on the one hand, and the width of the shoulders, the distance between the nipples and the antero-posterior diameter on the other (Brent); but as the perversions of these relationships do not furnish any precise diagnostic inferences, it is unnecessary to describe them.

97. The two sides of the chest are of unequal semi-circumference in about five-sixths of healthy adults; a mean excess of about half an inch existing on the right side in right-handed individuals;* in left-handed persons the left side sometimes measures more than, or more frequently the same as, the right. These propositions hold true of both sexes; but the difference is slightly greater in males than females. As in infancy and youth the two sides scarcely differ, it seems probable the non-symmetry of the adult chest depends on the excess of use of the right side. I have not traced any special influence of trade on these measurements; but accidental circumstances, unconnected with disease of the thoracic organs, are liable to modify their ratio. Thus, distension of the stomach with flatus or food may equalise the measurement, for the time it lasts, on the two sides inferiorly; and I entertain no doubt that the deficiency of motion, kept up by fractured ribs in some cases for a very lengthened period, perhaps for a life-time, may in the end diminish the dimensions of the side,—the lung probably, just as in cases where its expansion and retraction are interfered with by pressure of a tumor on a main bronchus, collapsing and becoming more or less atrophous, while the thoracic walls fall in proportionally.†

* This excess becomes the more remarkable, when the frequency of slight convexity of the dorsal spine to the right, in health, is considered.

† Case of Bassett (U. C. H., *Males*, vol. ii. p. 214); the right side (the man being

98. The most important *morbid conditions* of circular dimensions are *increase or diminution of width* of either side, as compared with the other. They occur respectively in the same diseases, already enumerated under these heads, as morbid expansion and retraction [31, 33].

99. *Of circular width midway between the nipple and clavicle* little has been ascertained: the scapulae prevent the real measures from being taken, and in some persons raise the circumference here above that on the level of the sixth cartilage. As far as is now known, the ratio of the upper and lower circumferences does not appear to me sufficiently constant to be trusted to clinically. It is matter of general belief that the size of the upper part of the chest, compared with that of the base, is greater in proportion as the muscular and osseous systems, especially the latter, are strongly developed, and the constitution of the individual free from the taint of predisposition to phthisis. Though not prepared to say positively whether the excess of width, existing at the lower part of the chest on the right side, holds in the upper regions also, I am inclined, from a limited number of observations, to believe that it does, though to a less amount than inferiorly.

100. (*b Transverse*).—Respecting mensuration of the transverse diameters of the chest, I have no precise information to offer. It should be made with a pair of callipers, and there can be little question that diagnostic data of importance might occasionally be derived from its employment. It would, however, in the greater number of cases, do little more than confirm the results of inspection; for diminution of the transverse diameter, in respect of the antero-posterior, the change which, it may be presumed, would most frequently present itself, is one of those alterations of shape which most readily attract the eye.

101. (*c Antero-posterior*).—A pair of common steel callipers is the simplest instrument for determining the antero-posterior diameter of the chest. The absolute maximum measurement varies widely,—the extremes I have actually noted in males of middle height, free from chest-disease, being eight and twelve inches. The difficulties, in comparing the diameters of the two sides, are to apply the blades of the callipers with exactly the same force, and (a far from easy task, on account of the slope of the sur-

right handed and free from pulmonary disease, capable of explaining the fact, measured opposite the sixth costo-sternal joint $10\frac{1}{4}$ inches, the left $15\frac{1}{2}$ inches: he had 14 fractured ribs on the right side. Compare this clinical fact with the result of Stromeyer's experiments on division of the posterior thoracic nerve [55].

of the chest), to exactly corresponding points on both

2. In measuring the antero-posterior diameter of the apex of the chest on either side, the extremity of one blade should be placed immediately under the centre of the clavicle, the other upon the corresponding point of the spine of the scapula,—the equidistance of both extremities from the middle line being at the same time carefully ensured. The diameter of the right side in this situation, as also over the sixth rib, will be found, in the average number of healthy persons, to exceed that of the left side, not only as a compensation for the relatively less height of the lung, but by so very small an amount that, where an excess is marked is detected on that side, the physiological disparity may be ignored. In other words, an excess of even a fourth of an inch on the right side, furnishes sufficient evidence of morbid expansion or diminished diameter on the left; though the existence of a similar excess on the left side will be still more strongly suggestive of contraction on the right.

3. The morbid states discoverable by the measurement now described are, *diminution* and *increase* of the antero-posterior diameter. The latter change occurs in pleurisy with effusion, pneumonia, hypertrophy of the lung, emphysema, intra-thoracic tumor and aneurism, various cardiac affections, acute general vascularisation of a lung, and possibly chronic tuberculous disease of the apex, at its earliest period [1236]. Diminution, on the other hand, arises in the more advanced stages of tubercle, in simple chronic consolidation, in the absorption-period of pleurisy with retraction, and in cases of prolonged mechanical obstruction to the entry of air through the larynx or main bronchi.

103 * Some twelve years ago Woillez invented an instrument, to which he gave the name of *Cyrtometer*, consisting of a series of small pieces of whalebone, articulated together so as to form a band, which, applied round any surface, retains the curves and indentations it is given, and of course allows of these curves being marked out on paper. By its means the perimeter of the chest may be accurately mapped out, the relative dimensions of the two sides seen, and the anterior curve of the chest, with the lengths of various antero-posterior diameters, defined. But the instrument appears to be troublesome in use, and reveals no new fact: it simply gives great precision to results more roughly (but accurately enough for diagnostic purposes) ascertainable by simpler means. Besides, it appears to me that a simple piece of soft metal wire,

which may be carried rolled up in the pocket, would answer the purpose intended, quite as well as the elaborate instrument. The only disadvantage I have found in using the wire is, that the impress of the two sides of the chest requires to be taken separately.

104. (*d*) *Vertical*.—The vertical measurement of the chest has hitherto been only practised in front; measured with a tape, the distance between the centre of the clavicle and the most dependent point of the corresponding ribs is found to be very closely the same on both sides.

105. This distance is liable to be *increased* in cases of solid, liquid, or gaseous accumulation in the chest; to be *diminished* in chronic pleurisy with retraction. But though elevation of the diaphragm, with consequent diminished vertical height of the thoracic cavity on either side, and also the converse states are not uncommon, changes of the measures on the *surface* are rare.

106. B. PARTIAL MEASUREMENTS.—(*a*) *Horizontal*. From the nipple to the middle line. The nipples are equi-distant from the middle line in the healthy adult male. The distance between either of them and that line is liable in disease to increase, and more frequently to decrease. Hypertrophy of the heart, pericardial effusion, mediastinal tumors and aneurisms in certain situations increase it, though not often seriously; on the other hand, diminution in cases of retraction after pleurisy, varying in amount from a quarter of an inch to an inch and a quarter, may be detected.

107. (*b*) *Vertical*. From the middle of the notch of the sternum to the nipple.—These points are equi-distant on the two sides in chests of perfectly regular form. We have already seen, however, that normally the left nipple sometimes lies lower than the right; hence the space comprised between the nipple and clavicle on that side may be greater than on the other, independently of the influence of disease.

108. The only *morbid variation* observed in this measurement is *increase*, and it is obvious, from what has just been said, that this sign will have more value on the right than the left side. And mensuration is less useful in respect of this sign than inspection; for, on account of the flattening of the surface, which commonly co-exists with lowered position of the nipple from disease, the superficial measurement undergoes a diminution which may more than compensate for the increase produced by the latter cause. In a remarkable example of this apparent contradiction

between the results of inspection and mensuration, although the left nipple was manifestly lower than the right, the distance between the former and its corresponding sterno-clavicular joint was only $5\frac{1}{2}$ inches, while that between the same points on the right side was $6\frac{1}{2}$ inches.* It is to be supposed that such will usually be the result of mensuration, where the retraction after pleurisy affects more especially the antero-posterior diameter.

109. The distances comprised between the *nipple and the antero-superior spine of the ileum*, and between the *most dependent point of the twelfth rib and the same process*, are equal on the two sides in health. They undergo *diminution* on either side in cases of marked retraction of the chest; and, probably, *increase* in those of expansion.

§ II. MENSURATION IN MOVEMENT.

110. There are two plans for submitting to measurement the influence of respiration on the dimensions of the chest; the one estimates the amount of antero-posterior movement, the other the amount of circular expansion and retraction attending the act.

111. (a) The former measure, which may be roughly taken at the apex of the chest by placing the thumb on the spine of the scapula, and the index finger beneath the clavicle, is effected with much greater precision by an instrument of very ingenious construction, named by its inventor, Dr. Sibson,† the "Chest-Measurer." In principle a callipers, of which one branch is movable, this instrument is capable, by means of an index and dial fixed to its movable branch, of indicating any change in the antero-posterior diameter of the chest or abdomen, even to the one hundredth part of an inch, and has enabled Dr. Sibson to establish the following, among numerous other, propositions concerning the respiratory movements in health. In the robust male the forward movement of the sternum and of the seven upper ribs ranges from one-fiftieth to one-fourteenth of an inch in ordinary inspiration, and from half an inch to two inches during deep inspiration.‡ On the five lower ribs the ordinary movement is less, and the forced movement greater, than over the upper seven. The movement is somewhat less on the left side than the right,

* Cyclopædia of Surgery, article *Empyema*, p. 102.

† Med. Chir. Trans. vol. xxxi. p. 353. A modification of the instrument has been proposed by Dr. Quain.

‡ Haller, estimating the effects of a moderate inspiration, found the forward movement of the sternum, superiorly, $2\frac{1}{2}$ lines, inferiorly from 3 to 8 lines.

below the second rib. The ordinary abdominal movement is about a quarter of an inch, the extreme ranging from about half an inch to an inch and a half.

112. Unless the expansibility of the chest be directly as the forward motion of the anterior parts of the ribs, the indications of the "Chest-Measurer" do not accurately express variations in the amount of the former. This is seen in health. The instrument shows, according to its inventor, that the forward motion is in the male greatest, during calm breathing, superiorly,—least inferiorly; while, during forced breathing, the lower ribs play relatively more than the upper. Now upon this it must be remarked, that the eye and circular measurement teach us that the exact reverse is the truth in regard of the really important clinical fact—expansile action [48, 49, 52]. Again, when the costal cartilages are stiffened by age or precocious ossification, the expansion may be greater materially than in the ratio of forward costal motion: the converse state of things will exist in youth. In disease, too, the forward motion of the chest, and its lateral expansion, may be very differently affected: in a case of large excavation under the left, and consolidation with small excavations under the right, clavicle, the lower part of the sternum and adjoining cartilages *receded* visibly during inspiration, yet a fair amount of *circular expansion* was produced by the act.* The deceptive influence of the torsion-movement of the ribs (which will apparently increase or decrease the amount of their forward motion, according as the movable rack is fixed near their lower or upper edge) must be borne in mind; the very delicacy of the instrument might otherwise mar its utility. But in localising with precision deficiency or excess of antero-posterior motion, and in estimating changes from day to day in the amount of either, the indications of the "Chest-Measurer" are greatly superior in perfection, it need scarcely be added, to those furnished by application of the hand.

113. (b) The span of inspiratory expansion and expiratory retraction of the chest and abdomen is measurable by the double tape already mentioned.† Applied closely, but not tightly, to the chest, on the level of the sixth cartilage, the tape shows that the

* Green, U. C. H., *Female*, vol. v. p. 146, July, 1859. The same phenomenon sometimes occurs in pleuritic effusion also.

† Sir Henry Thompson, several years ago, suggested a very simple addition to the tape-measure, whereby the absolute and relative expansion of the two sides of the chest may be ascertained during one and the same respiration. The more ordinary plan requires two; and as no two respirations are probably precisely equal, the arrangement in question, which may be had of Coxeter, Grafton Street, obviates a source of fallacy.

expansion accompanying ordinary calm inspiration in health is very slight, averaging about a quarter of an inch in the healthy male adult, with a circumference of thirty-three inches: this amount is, practically speaking, shared equally by the two sides. In forced inspiration the circumference is increased from the medium or tranquil state by from one and a half to three inches, and is somewhat greater on the right than on the left side,—the deficiency on the latter mainly depending on the heart. The total circular difference between forced inspiration and forced expiration ranges between two and a half and five inches; this is estimated by taking admeasurements at the moments the patient has been made first to fill, and then to empty, the chest to the greatest possible amount. At the same time the difference in the respective extremes on the two sides is seen. But the same amount of difference may exist between extreme inspiration and extreme expiration on the two sides, and yet be very differently produced: it may, on one side, depend in the main on great expansion above, and on the other on great retraction below, the *medium state*; in other words, inspiration may be free to excess on the former, expiration on the latter, side. In health, however, such want of harmony in the expiratory and inspiratory efficiency on the two sides is never met with, except to the very slightest calculable amount, and is probably traceable to the difficulty of the observation.

114. The chest-play is remarkably under the influence of posture; least in decumbency, it increases successively, chiefly in its inspiratory division, in the sitting and standing postures,—very much in the ratio of the increasing frequency of respiration.

115. Forced breathing has scarcely any influence in expanding the abdomen: in a healthy male adult, now under observation, five feet six inches in height, in whom, while standing, extreme expiration gives a circumference opposite the sixth cartilage of $29\frac{1}{2}$ inches, and extreme inspiration, one of 34 inches (a very rare amount of thoracic play, especially with so low a stature), the abdominal inspiratory expansion equals only a quarter of an inch.

116. *In disease*, mensuration ascertains with accuracy the amount of deficiency of expansion on both sides, and on one side as compared with the other, the mere existence of which deficiency is more or less readily ascertained by the sight and touch. The Section on Inspection [54] may therefore be referred to for a list of the affections in which deficient expansion is to be estimated by measure.

117. The variations from the healthy standard thus discoverable are sufficiently striking. In chronic empyema, for instance, the total difference between the fullest expiration and the fullest inspiration on the affected side may scarcely reach one-sixteenth of an inch; while the other side, especially if time has elapsed for its lung to grow hypertrophous, may have a play, as I have actually witnessed, of nearly two and a half inches,—an amount reaching the limits of health for both sides united. Hemiplegia will materially lower the respiratory play on the affected side: thus, in two cases elsewhere described,* the range of motion on the paralysed side equalled in each about a quarter of an inch, while that on the non-affected side measured in one instance three-quarters of an inch, and in the other an inch. Again, paraplegia, if reaching as far upwards as the chest-wall, will cause a sensible diminution in the circular measurement in the male at the base during inspiration, and an equal increase during expiration.† Precisely the same perversion may be occasionally established in cases of obstruction of the upper air-passages.‡ The principle at work in both cases has already been explained [54].

118. When the respiration-play of both sides combined does not reach two and a half inches, disease impeding respiration in all probability exists; and when the total amount being equal to, or exceeding, a healthy average, the shares of the two sides are notably unequal, disease exists, impairing the play of one side, and possibly exaggerating that of the other.

119. But the measured range between forced expiration and forced inspiration may be the same on the two sides, and yet the accompanying change of volume of the two lungs be very different in kind. On the one side the play may be chiefly effected by the ready inspiratory expansion of the lung,—on the other, by the great efficiency of expiratory contraction. In the former case the lung maintains its relative efficiency by its power of taking in beyond its medium quantity of air: in the latter by its power of expressing air, which in ordinary breathing stagnates within it; in the former case expansibility, in the latter elasticity, predominates. Here are two very different conditions of lung, most important to be distinguished, and which have hitherto never been made the subject of clinical study. The difficulty of the study is, it is true, extreme, from the nicety required in fixing the standard

* *Clinical Lectures*, "Lancet," March 17, 1849.

† Cozens, U. C. H., *Males (acute myelitis)*, vol. xvi. p. 267.

‡ Sams, U. C. H., *Males (chronic obstructive laryngitis)*, vol. xvi. p. 272.

of comparison, namely, the medium or tranquil measurement of the chest. My observations on this matter are as yet too limited to justify me in announcing general conclusions; but they prove to me that with care the inquiry may become rich in results. It seems almost a matter of necessity that, as the difference of power in the two cases directly bears on different portions of respiratory air, the influence on the oxygenating process must vary in each. Where the expiratory force is in excess, the "supplementary" air [122], where the inspiratory action predominates, the "complementary" air, must be severally most affected.

120. The forced breathing of health expands the chest in both sexes and at all ages, out of all proportion with the abdomen. In the forced breathing of diseases seriously affecting thoracic expansion, the diaphragm on the contrary assumes unusual energy, descends more than natural and expands the abdomen in excess. Severe pleurodynia will suffice to transpose the respiration-movements in this way; I have known the pain attending herpes zoster [66] do so to a slight extent. Where local rheumatism affects the parietes of both the abdomen and chest, it is curious to observe the medium state of modification in the relationship of abdominal and thoracic expansion in forced breathing: the pectoral expansion is relatively somewhat less, the abdominal somewhat more, than the healthy average.*

§ III. MENSURATION OF CAPACITY FOR AIR.

121. Although the results of mensuration in movement may be taken as fair indices of the relative amounts of air circulating in the lungs of different individuals, and of the same individual at different times, it is plain they give no idea of absolute amounts. But direct attempts have been made with the help of various instruments, to fix the entire volume of air admitted into the lungs, under varying conditions of health and of disease.

122. Now the air habitually present in, or capable of being introduced by respiration into, the lungs, is divisible into various quantities. First, there is a volume of air which remains in the cells even after the complete collapse of the lungs in the dead body, and which cannot, by ordinary means at least, be artificially expressed from their tissue, though thoroughly removable by the influence of certain diseases, especially those causing fluid pressure on the pleural surface of the lung: this may be called *per-*

* Farrett, U. C. H., Males, vol. vi., Nov. 1850.

sistent air. Secondly, a volume, which, though collapse expels it after death, cannot be expressed from the lungs during life by the strongest expiratory effort; this may be termed *residual air*.* Thirdly, the volume of air, which can be expelled by a forced, after an ordinary, expiration, may be termed *supplementary*. Fourthly, the *breath*, or *tidal*† air, that which in flux and reflux passes to and fro in calm breathing. Fifthly, the volume which can be inhaled by a forced, after an ordinary, inspiration,—and may be given the name *complementary*. The persistent, residual, and supplementary airs together, may be styled *stagnant air*; while the sum of the supplementary, tidal, and complementary quantities, may be named *total movable breathing volume*. Tabularly they would stand thus:—

$$\text{Stagnant} = \left. \begin{array}{l} \text{Persistent} \\ \text{Residual} \\ \text{Supplementary} \\ \text{Tidal} \\ \text{Complementary} \end{array} \right\} = \text{Total breathing volume.}$$

123. The earlier attempts at estimating these volumes, either singly or in combination, varied so ludicrously, that to obtain physiological standards seemed hopeless. Healthy types proving unattainable, the application of pneumometry to the clinical study of disease, could not, in spite of the efforts of Kentish and Herbst, prove successful. And yet these observers, more acute than their predecessors, recognised the influence of various collateral conditions on the breathing volumes. Others have since done so even more fully; still the most perfect results are, it is to be feared, only approximatively true.

124. Thus M. Bourguery,‡ investigating what he terms the “Measure of respiration,” which, I find, proves to be the compound of the tidal and complementary airs, or the amount ex-

* In some cases of Cholera Asiatica expiration of the residual volume seems to be effected *in actu mortis*, and there is a tendency to this result for some time before death.

† I here adopt, for the most part, the terms devised by Mr. Jeffreys (“Statics of the Chest,” Lond. 1843). The distinction made in the text between persistent and residual air, has not, so far as I know, been hitherto recognised; but it is evidently real. Of course it is the volume only, not the actual same air, that is persistent: the fact of such persistence, shows the vital importance of the law of diffusion of gases (in the inverse ratio of the square roots of their densities) as unravelled by Mr. Graham; were it not for that diffusion, scarcely any fresh air, at least with the existing mechanics of respiration, could reach the air-cells for the purposes of blood ventilation. In this statement I do not even by inference mean to express an opinion on the vexed question, whether the actual interchange of elements of the air and blood takes place in obedience to the law of diffusion, or, as Visconti and others maintain, to that of absorption, of gases. It would, however, certainly appear that the presence of moisture is fatal to the activity of the former law.

‡ *Mém. de l'Acad. des Sciences*, Janv. 1843.

elled by a forced expiration after an ordinary inspiration, shows this volume to be deeply influenced by age, sex, and leanness, or the reverse, of person. Health and vigour of body do not compensate for youth and thinness. The function reaches its maximum at the age of thirty;* at this period a forced inspiration will add to the stagnant air 2.5 to 4.3 litres in the male, from 1.1 to 2.2 litres in the female.† The boy of fifteen can inspire 2 litres, the man of eighty but 1.35, a significant measure, I may observe, of the incapacitating influence of senile atrophy of the pulmonary parenchyma.

125. Dr. Hutchinson,‡ in turn studying by means of his ingenious instrument, the Spirometer, the quantity of air which may be expelled from the chest by the fullest possible expiration, surpassing the fullest possible inspiration (that is, the sum of the supplementary, tidal, and complementary airs, or the total movable breathing-volume), affirms that the physical conditions dominating all others, which influence breathing, are stature§ and weight. His experiments lead to the inference, that the total breathing-volume (or "vital capacity") varies in a definite and calculable ratio with the height of the individual: that the mean for the male, at the height of 5 feet, being 174 cubic inches, it increases, at 60° Fahr., with every inch of stature between 5 and 6 feet, by eight additional cubic inches.

The experiments of Dr. Hutchinson have been repeated on a large scale in this country, in various parts of Germany and in the United States; and the clear formal result of the entire series is that while the *rule* is subject to numerous exceptions, the

* If this be true (and subsequent researches seem to confirm the statement), the discovery lends incidental support to the notion that no fixed ratio holds between the breathing volume and the girth of the chest, for, as before stated [43], the circular width increases with advancing years.

† The influence of sex was, however, originally ascertained by Thackrah, who states that "while healthy men inhale by the pulmonary 200 cubic inches and upwards, women rarely exceed 100, and often do not reach that amount." (*Effects of Air*, 4th ed., 8vo, and edit. p. 181. 1832.)

‡ *Med. Chir. Trans.* vol. xxx. 1846. A simple spirometer, tolerably accurate in its measurements, and easily carried in the pocket, has recently been invented by Dr. J. H. Hutchinson, of Great Street, and is sold at a small price. The objection, raised to Hutchinson's spirometer as a perfectly accurate measure, by Dr. E. Smith, and others, on the ground of its mechanical imperfections, is well founded; but as compensations for absolute results are wanted, mathematical precision in the indications is not so much in practice at least, as in absolute requirements.

§ Knapp, the inventor of the pulmonary, first drew attention to the influence of stature on breathing volume ("Amount of Breath, &c., with a Description of a Pulmonary," pp. 87, 90, 119. London, 1810), more recently Herlitz categorically insisted on the importance of the capacity der Lungen für Luft on *personellen und anatomischen Zuständen*. *Möckel's Archiv*, 1828, pp. 98, 101. But neither of these observers was probably that wise of their successors, attempted to deduce a precise ratio between capacity and height.

alleged *law* has no real existence. Dr. Pepper,* in illustration of the wide interval between extremes in healthy persons, gives the two following instances: height 6 feet, vital capacity equal 151 cubic inches; height 5 feet 10½ inches, vital capacity equal 202½ inches. Such enormous differences as these (and they are by no means of very uncommon occurrence) thoroughly warrant the incredulity of Fabius and others as to the reality of any precise ratio at all existing between stature and breathing capacity.

125*. Conscientious and well-designed attempts have been made (those of F. Arnold† holding the foremost place among them) to prepare more trustworthy standards by including, as elements influencing the result, various other conditions besides mere stature. Nearer approximations to the truth have thus been obtained beyond a doubt. But, even thus improved, can these physiological results be applied with confidence in thoracic diagnosis? I apprehend not. For M. Bourger's mean general standards for sex, age, and varying leanness of person, and Dr. Hutchinson's, as modified by Arnold, for stature, &c., being *argumenti gratia* admitted, the question arises, what precise or even approximative oscillations above and below those standards are compatible with health? Now not only can no positive reply at the present day be given, but such is the intricacy of the problem, it seems unlikely ever to be furnished. Conceive the complexity of the case when as conditions independent of thoracic disease positively affecting vital capacity (and there may, for aught I know, be many more) must be enumerated the following: age, sex, degree of corpulence, amount of muscular strength, and general vigour, posture of the body, circumference of the thorax,‡ height of the thorax, height of the body, weight of the body,§ mobility of the chest-walls, relation between the depth of the chest and the stature, the relation between the outer girth and the internal area of the thorax, the class of the individual in society,||

* Amer. Journ. of Med. Sciences, April, 1853, quoted by Flint, On the Respiratory Organs, p. 45.

† Ueber die Athmungsgrösse des Menschen, Heidelb. 1855.

‡ The paradoxical notion that width of chest had nothing to do with vital capacity has been disproved by Arnold; common sense showed it must be an error.

§ It is difficult to see *a priori* why a man should breathe in the direct ratio of his weight. I feel convinced it will be found the simple reason heavy people breathe most is, that greater weight is generally associated with greater height,—weight being an accidental coincidence of the supposed real governing element, height.

|| Arnold found that the upper classes generally have a smaller vital capacity than the humbler orders. Occasionally trade seems, according to the results of this observer, to exercise a singularly dominant influence.

the trade or occupation, sedentary habits or the reverse, the mode of dress, the customary attitude, habitual nutritious feeding or the reverse, the amount of food in the stomach at the time of experiment,* fulness or emptiness of the bowels,† and the congested or non-congested, healthy or diseased, state of the abdominal organs generally.

126. The calculation has, no doubt, been offered for Dr. Hutchinson's results, that a deficiency of 16 per 100 is suspicious, but may possibly arise from physiological peculiarity,—that beyond this, the deficiency is morbid. But in clinical practice it turns out, that the *general* standard of height, even with this correction, is often valueless,—that the *individual* healthy standard often varies far too widely on either side of the general one. So much so, that a great fall may have taken place, from disease, in the breathing volume of an individual, at a time when he expels a quantity of air above the average standard of men of his height: according to the general standard he is more than healthy, he is extra-capacious; according to his own, he is diseased. For certainty of observation, the individual standard is required; the present man must be compared with the past man, and not with other men. And even in this limited application of the spirometer, there are serious difficulties; a slight variation in general vigour at the different periods (the influence of strength is very notable) will of necessity modify the results.

127. I am disposed to believe that any fall below the general average, is a surer indication of disease, than the maintenance of that average, or even of a slight excess, is of health.† But of what disease? Obviously of any disease, whether situated in the lungs and appendages, the heart or great vessels, the abdomen, the encephalon or spinal cord, the vagus, phrenic or intercostal nerves, which interferes on vital or mechanical principles with the expansion or retraction of the lungs. The spirometer indicates when the lungs receive an insufficient supply of air, but gives no inkling of the cause of the deficiency,—unless observation should prove (what is utterly improbable, not to say impossible) that

* The decrease in the respiratory capacity after a meal varies, according to Wintz, from 60 to 200 cubic centimetres.

† Fabius found that his man-servant increased 250 cubic centimetres in the "vital capacity" of the lungs after the use of an ounce of lenitive electuary (Arnold, loc. cit., p. 96).

‡ I have known a patient with cavities in his lungs expel considerably more air than that indicated for his height in the scale of health. He was only 5 feet 4 inches tall: I have not observed this with persons of good height; though with such persons, on account of the presumed influence of length of chest, it might *a priori* be particularly expected.

special scales of reduction of breathing volume obtain in particular diseases. The spirometer, too, tells nothing of the distribution of the air inspired,—in this view clinically inferior even to semi-circular and antero-posterior mensuration, which point out the side and the region receiving too much or too little air.

128. For these and other reasons the spirometer affords no help, where, the presence of pulmonary disease being certain, its nature remains an insoluble problem by other methods of physical diagnosis. The weight of the allegation that a fall of breathing-volume has been detected in a given individual, eventually destroyed by phthisis, at a time when no ordinary physical sign of pulmonary disease existed (or, at least, was discoverable by a particular observer), will be else where considered [1309].

129. On the other hand, where the object is to ascertain roughly and rapidly the general soundness of a body of men, as in the instance of recruits, the indications of the spirometer may, with practice on the part of the observer, be accepted as significant. Yet only significant as far as the naked fact of breathing well or ill goes, and goes at the particular moment of the observation; any deficiency detected in individual cases may, as we have just seen, depend on some one or more of a multitude of causes either compatible with, nay, even promotive of, health [125*], or indicative of diseases utterly disconnected with the lungs [127]. The nature of the significance is matter for ulterior determination.

130. And it must not be forgotten that the practical sources of fallacy in the use of this instrument are numerous. Some persons cannot be taught to inspire properly; others to use all the air they actually inhale: some from simple indolence and indifference fail to "blow" an amount they are well capable of; others stimulated to extra-laborious effort, in the hope of proving themselves in more robust health than they really feel, mark higher in the scale than many with more capacious lungs: some by habit learn, after a time, to utilize the total volume, a great part of which in early trials was lost (just as persons endowed with even the humblest vocal faculty, acquire by practice greatly increased power of sustaining notes); while others with equal habit are, from mere stupidity, as bad "blowers" at last as at first.

131. Would the variations of the tidal air furnish clinical data of greater importance than those of the total breathing-volume? Possibly; no proof exists at least that because an individual can

under an effort take in a surprising quantity of air, he therefore habitually circulates and consumes the volume necessary for the maintenance of health. Mr. Jeffreys has calculated that in the healthy adult male this quantity oscillates between 16 and 40, and averages 26, cubic inches; while Vierordt found the amount in his own person ranged between 10·8 and 42·6 cubic inches.* The wide range compatible with health points to the infinite difficulty, it is to be feared the impossibility, of obtaining serviceable results in disease.

132. It follows from this variation in the amount of the tidal air, that a like variation must exist in the quantum of lung-substance brought into play in ordinary breathing. The extremes of that variation are unknown; the mean amount habitually utilized is small, and probably does not exceed one-fourth of the total pulmonary mass.†

133. The muscular force of expiration is considerably greater in the forced breathing of health than that of inspiration, in about the ratio of 8·03 : 5·68 according to Valentin. Of their relative power in calm breathing we know nothing by actual experiment; but calm inspiration being essentially a muscular effort—calm expiration in the main a mechanical result of the cessation of that effort—there is more waste of power in the former than in the latter act.

134. The inspiratory power sometimes exceeds the expiratory in disease [119].

SECTION IV.—PERCUSSION.

135. The act of striking the external surface of the chest for purposes of diagnosis is called Percussion; its immediate object is to determine the density of subjacent parts. Inferentially, the process serves to establish any increase or diminution of the quantity of air naturally contained within the thorax, as well as the site and area within which the change has occurred. Statically it tests, both in regard of different individuals compared with each other, and of the same individual at different periods and

* Vide his article *Respiration*, in Wagner's *Handwörterbuch*, p. 835. 1844.

† I base this statement on the following rough experiment. Ascertain what force of action with the bellows, introduced past nostrils into the trachea, produces a somewhat greater amount of expansive and retractive movement in a given chest, than the taking pause in the calm breathing of life. Then remove the chest-wall sufficiently to bring the lungs into view, inflate with the same force as before, and it will be seen scarcely a fifth of the lung substance comes into action;—some allowance must be made for the changed relations of atmospheric pressure caused by cutting away the chest-wall.

under varying conditions, the quantity of stagnant air [122],—dynamically the amount of tidal and complementary air, any given lungs receive and circulate. It indicates also the presence of air, of fluid, and of solid substances in unnatural localities within the thorax.

136. Percussion ascertains the existence and amount of variations in density of the chest by: (a) The nature of the sound elicited by percussion; (b) The degree of resistance, or combined elasticity and tension, of the part percussed.

137. (a) *Percussion-sound*.—English writers, as a body, have hitherto employed only two terms to indicate the varying characters of thoracic percussion-sounds—namely, dulness and clearness. The inaccuracy and inadequacy of these terms have long compelled me to relinquish them in clinical teaching. They are inaccurate and inadequate: first, because dulness and clearness are not terms opposed to each other, either in the popular signification of the words or in an acoustic sense; secondly, because dulness and clearness* are not admitted among the properties of sound by acoustic philosophers;† and, thirdly, because it is demonstrable that the words have been conventionally adopted to represent conditions which, assumed to be simple, are in reality made up of several elements, capable of separate analysis. Besides, the use of the term clear often leads into error. High-pitched resonance with hard quality possesses a considerable share of what is conventionally called clearness, and clearness is held always to indicate health. Now this form of clearness is often discovered at a tuberculized apex, while the other lung, relatively, or it may be practically speaking wholly, free from tubercle, retains the deeper and less clear tone of normal resonance. Possessed by the notion that clearness is the unfailing index of health, the observer takes the really diseased for the sounder organ of the two.

* The word clear applied to sounds, strictly speaking, means pure. The notes of an instrument are said to be clear, when they are heard singly and purely, uninterfered with by any extraneous vibrations;—the tones of the human voice, when free from huskiness or any other superadded character impairing their singleness. Now, in this sense, no sound elicited from the chest by percussion can be called clear; and, what is yet more important, several of its morbid tones, furnished in disease, have more of so-called clearness than the resonance of the healthy thorax.

† Hence there is this curious contradiction in the works of various writers on physical diagnosis, who profess their volumes with inquiries into the theory of Acoustics, that no such properties as dulness or clearness are ascribed to sound in general, and yet dull and clear sounds are perpetually spoken of in subsequent descriptions. Again, dull sound is used as synonymous with "little" sound, or "no" sound. This is sometimes, but not always, correct. There is, in point of fact, as intense noise in many so-called dull as clear, sounds: it is not in *intensity* that the difference which impresses the ear consists, but in *duration* and in *pitch*, and sometimes in *quality*, so long as they both last, one may be as intense as the other.

138. Separation of the elements alluded to will lead us to a truer, and hence, though it may seem more complicated, a really more practical distinction of percussion-sounds than that commonly employed.* Care will be taken, in the description of morbid states of percussion-sound, to point out how the old terms stand related to those which it will be proposed to substitute for them.

139. There is no abstract reason why the human chest, when struck, should not give forth sounds possessed in various degrees of the several properties of sonorous bodies in general. But, as matter of experience, the acoustic properties of thoracic percussion-sounds, which are clinically serviceable, prove to be *amount* (or *intensity*) of *resonance*, *pitch*, *quality*, and *duration*. These properties vary with the density, tension, and certain other physical conditions of the textures and materials furnishing the sounds.

140. *Amount* (or *Intensity*) of *Resonance*.—All wet animal textures in a state of relaxation, with the exception of bone and cartilage, which possess a well-toned resonance, furnish a toneless sound, or rather a mere noise under percussion. The viscera are indeed, practically speaking, almost non-sonorous in themselves,—the proper substances of the liver, spleen, kidney, heart, and lung, from which the air has been artificially expressed, do not to any readily appreciable amount differ in regard of this property: all of them are deficient in the molecular elasticity required for continuous and toned sonorousness. Hence the resonance of the lungs, of which we speak clinically, depends not on their proper tissue, but on the air they contain, and on the construction of the case in which they are contained. The quantity of bone and cartilage entering into the composition of that case, its hollowness, and the thinness of its walls, in comparison with the extent of its cavity, all conduce to the freedom of sonorous vibration. So, again, equal portions of heart-substance and of liver-substance, when similarly percussed, and under similar surrounding conditions, will give out sounds short, abrupt, and toneless, to ordinary ears undistinguishable from each other. But if a left ventricle, *unopened*, be percussed lying on a plane surface, its sound will be found more intense, of longer duration, and of lower

* The division of percussion-sounds into *full* and *empty*, made by Skoda, seems to me inadmissible (independently of the confusion produced by the use of the word *empty* in a sense wholly different from that it commonly bears) on grounds extremely well set forth by M. Aran in his translation (p. 37) of that author's treatise. Why, among other things, establish a series of sounds from the "full" to the "empty," and then, as Skoda actually does, only use the latter term of the series?

pitch than that of an equal thickness of liver-substance: the air enclosed in the ventricle is doubtless the essential cause of the difference. *A fortiori* will the properties of the sound emitted by these two organs *in situ* variously differ. M. Piorry maintains there is a specific difference in the intrinsic percussion-sound of the actual substance of the different viscera, when removed from the body: M. Skoda as confidently affirms there is none. Absolute truth lies, I believe, with Piorry. As every kind of solid material, wooden, metallic, &c., has its distinctive resonance; so too must animal tissues of different molecular compositions possess theirs,—but the vibratile qualities of those tissues are so imperfect that the differences between their sounds may practically be ignored: in fact they are, as I have just admitted, quasi-inappreciable. I disagree, too, with Skoda (and this on the ground of actual experiment) in the opinion that there is no difference in the percussion-sounds emitted by a viscus, say the liver, when in a “hard” and a “soft” state. Practically, however, all this is of very secondary importance; the point of real clinical interest is the resonance of the viscera *in situ*.

141. *Pitch*.—Liquids emit under percussion a higher-pitched sound than solids, solids than gases. The pitch of the healthy chest-sound will vary, therefore, according to the amount of solid substance or of air immediately beneath the part struck: it will be notably higher over the heart and liver, for instance, than in the infra-clavicular and axillary regions. *Ceteris paribus*, the greater the quantity of air in the part struck, the lower the pitch. Habit alone will familiarize the ear with the normal type, which, as will by-and-by be fully shown, varies materially in different parts of the chest.

142. As a single property of percussion-sound, clinically considered, emphatic alike in its diagnostic and prognostic significance, I have no hesitation of placing pitch in the first rank.*

* This conviction has been gradually growing on me since I first suggested the probable connection between so called “dulness” and “clearness” and modifications of pitch, in 1843 (*Physical Diagnosis of Diseases of the Lungs*, p. 170). Skoda, I am aware, takes a very different view, according to him changes of pitch “are of the least practical worth” (2nd edit. p. 12). And his French translator, M. Aran (p. 39), merely admits that “perhaps at some future day the idea of intonation may furnish some diagnostic results.” On the other hand, Dr. Austin Flint (*Sur les Variations du Ton*, &c., Paris, 1854) has recognised their importance, and submitted them to serious study. M. Wuller, too (*Archives de Médecine*, &c. 1855), deserves particular mention in connection with this subject. But I cannot help dissenting from this excellent observer in his exclusion of *quality* from the essential attributes of percussion-sounds, this exclusion it is that leads him into the error, as I conceive it, of looking upon the variety of sound I have called *notes*, and in certain cases even the *notes*, as nothing more than peculiarities of high pitched resonance (*loc.*

143. Differences of pitch are, even by untutored ears, roughly distinguishable in percussion-sounds emitted by various parts of the chest. But more than this, it is quite possible by a little management, and first ascertaining the absolute sound of various spots, to produce a series of notes in ascending and descending scales (at regular or irregular intervals as the case may be), if various amounts of hardening and of rarefaction co-exist in the lungs, and especially if these be associated with fluid accumulation [180]. And, doubtless, these notes might be made the subject of precise musical notation—tones, half-tones, and quarter-tones being distinguished,—where the education of the ear had been carried to the necessary degree of perfection.* It must be remembered, however, that in the chest, the number of gradations perceptible to a very trained ear between any note and that next above it, may be considerably greater than those signified by a quarter, half, and three-quarters of a tone,—a fact which would constitute, I presume, an almost insuperable practical difficulty in the way of musically notating *all* percussion-sounds of a diseased chest. But the mere fact of difference of pitch in any two spots is readily ascertainable,—as likewise rise or fall of pitch in any one spot: in the latter changes may be found occasionally a precious guide in prognosis.

The greater the tension of the part struck, the higher the pitch of the resulting note.

144. *Quality*.—The quality or *timbre* of the sound emitted by the chest immediately over healthy lung-substance is not easily described: the usual statement, that it is a "good clear" sound, manifestly gives no distinct notion of its nature. It conveys the ideas of softness to a marked, and of hollowness to a slight, degree; but it is in fact *sui generis*, and to be learned only by experience [165]. The nearest similitude is probably that of Avenbrugger, who likened the normal chest-resonance over lung to the sound of a drum covered with coarse woollen cloth: it might be called muffled-drumlike.† Fortunately this *pulmonary*

[181]. The pitch may be the same of a *wooden* percussion-sound over an indurated spot as of the so-called *dull* sound over a certain thickness of pleural fl.

* A patient once exclaimed, while I was percussing his anterior apices, "That sound has fallen a quarter of a tone, since you last examined me,"—referring to the note under the clavicle. The two examinations were made at an interval of fourteen days only. It may be well to add, in explanation of the patient's acoustic acuteness, that he was an orchestral player.

† And, on the v, much of trumpe-like quality (say that of pneumo-thorax) signifies *pathologic* cases in regard of its acoustic effect on the ear, than exaggerated normal resonance. To suppose I have always had, nor can I discover on what grounds M. Aran, in his translation of Skoda (p. 14, note) ascribes to me a different notion.

quality is sufficiently marked and peculiar to render the morbid variations easily appreciable.

145. *Duration*.—Difference of the duration of the sounds emitted by bodies of different kinds under percussion may be illustrated—if examples of the familiar fact be required—by the prolonged ringing *tone* produced by striking a gong, and the short abrupt *noise* similarly yielded by a mass of putty. The disparity in these two instances is considerably greater than any observable in percussing the human body, but less degrees can readily be conceived: that existing between the sounds emitted by the thigh and the cranium exemplifies one of those degrees.

The duration of the percussion-sound varies also very distinctly in different parts of the chest; perceptibly longer, for instance, at the upper part of the sternum than over the heart.

146. As in the case of all sonorous bodies, so with the different portions of the chest, a certain relationship subsists between the four properties of sound on which we have just commented. The note in the infra-clavicular region being of a certain intensity, pitch, duration and quality, that over the centre of the heart-region will relatively lose somewhat in intensity, rise notably in pitch, lessen in duration, and grow harder in quality. As a rule, to which the exceptions are very few, the greater the mass of subjacent air in the chest, the greater will prove the intensity, the lower the pitch, the longer the duration, the softer the quality of the percussion-note.

147. (*b*) *Degree of Resistance*.—When percussing a chest immediately over lung perfectly free from all disease, the observer is conscious of a slight yielding motion on the part of the walls, accompanied with a sensation of elasticity. It is impossible to fix a standard of this elasticity, but the reality of its existence may at once be ascertained by percussing comparatively the anterior part of the thorax and the thigh; in the latter situation a sensation of dead unyielding resistance is experienced. The amount of resistance is increased by all conditions raising the pitch, shortening the duration, and hardening the quality of the percussion-sound.

148. *Manipulation*.—Considered in respect of the manner of manipulating, percussion is either *immediate* or *mediate*.

149. *Immediate* percussion, the invention of Avenbrugger, is performed by striking the surface of the chest with the tips of the four fingers of the right hand, united into a point on a level with each other, the ball of the thumb being placed firmly against the

index-finger opposite the articulation of the second with the third phalanx, so as to support and give firmness to the fingers. The hand being thus prepared, the points of the fingers are brought perpendicularly down upon the surface with a sharp and quick stroke, which is found to produce a sound varying in a certain definite fashion with the condition of the subjacent parts. Immediate percussion may also be performed by striking the chest with the palmar surface of the fingers. Some physicians tap the surface lightly with the small end of the stethoscope: but patients always dislike this, and it may be productive of serious pain.

150. Immediate percussion has, however, almost completely fallen into disuse, less in consequence of the positive objections to its employment than of the invention in mediate percussion of a plan, if not more ready in its application, much more satisfactory in its results. There are, nevertheless, a few circumstances under which immediate percussion may still be had recourse to with advantage. Thus, in cases where extensive and notable difference between the two sides exists, rapidly striking them with the palmar surface of the hand will leave no doubt as to the fact; indeed it will disclose the amount, though not the superficial extent, of the alteration of sound, almost as satisfactorily as the more delicate process of mediate percussion. In cases of hepatisation and of pleuritic effusion, where it may be inconvenient to submit the patient to a lengthened examination, this method, therefore, has its utility. Again, it will be found that directly tapping the clavicles and spines of the scapulæ with the points of one or more fingers, or with the bent knuckle of the index-finger, conveys as correct information as mediate percussion of those parts.

151. The distinctive character of *mediate* percussion, for the invention of which we are indebted to M. Piorry, is that some solid body, interposed between the chest and percussing agent, receives the direct impulse of the latter. In mediate percussion, or, as I shall in future call it, simply, percussion, there are two chief things to be considered—the material interposed, and the agent used for striking it.

152. The material interposed, termed a pleximeter (πληξίς, percussion, and μέτρον, a measure), may be of different kinds. That employed by M. Piorry is a thin, circular, or oval plate of ivory, about an inch and a half in diameter, and provided with two prominences or handles, fixed at right angles to its plane surface, and at nearly opposite points of its circumference; these

enable the observer to hold it steadily, and apply it evenly and firmly to the surface. Innumerable have been the modifications of this, and the varieties of new pleximeters, proposed from time to time; of these, a finger of the left hand (Skerrett?) and a flat piece of india-rubber (Louis), are in my mind decidedly the best. The index or middle finger, on account of their always being within reach, on account of the accuracy with which they may be fitted, as it were, to the various depressions on the surface, and on account of the absence of parade in their employment, will no doubt always continue the pleximeters in most common use. They have in these points of view, an unquestionable superiority over M. Piorry's plate of ivory. The india-rubber pleximeter may, however, be defended: there is nothing pompous in its appearance, and by a little management it may be accurately applied, even in the intercostal spaces of the thinnest persons. It has, besides, this positive advantage, that it saves the finger of the operator,—no trifling matter, where a very large number of patients are to be examined. And its use implies a saving of pain not only to the operator, but also to the patient, as I ascertained some years ago by a considerable series of comparative trials. I have known females with cutaneous hyperæsthesia bear percussion without murmur in this way, who resolutely refused to allow it, the finger being used for a pleximeter. The only objection I have ever heard urged against the india-rubber is, that it deadens the sound. This, which would be a valid argument if a single point only of the chest were to be percussed, and a direct inference drawn from the result, has in reality not a particle of force; because inferences are invariably drawn from the comparison of different parts.

153. Whatever pleximeter be employed, it should be placed in accurate and firm contact with the surface; for this reason it appears advisable to apply the palmar, and not the dorsal, surface of the finger to the chest, when this is the pleximeter used. No extrinsic condition modifies the sound so much as the amount of force with which the pleximeter is applied to the surface; and the finger with its dorsal surface turned to the chest is, in this point of view, comparatively unmanageable. The validity of this objection is, however, not universally felt; M. Louis, among others, very frequently percusses in this way, and Dr. Stokes, to judge from his writings, appears to prefer it. It is certainly, in some cases, easier to apply the dorsal than the palmar surface of the finger uniformly to the part of the chest under examination;

but this advantage has always seemed to me much more than counterbalanced by the disadvantage just insisted on.

154. The finger may be applied parallel to the ribs, or at various angles with them. The former way of placing it is the more common; and, as a general rule, is the more correct, for by it only can the finger be fitted, in thin persons especially, to the irregularities of the surface. But it is sometimes both convenient and advantageous to vary the direction of the finger; and, as it is next to impossible to place the finger uniformly and equably against the surface in the neighbourhood of the right acromial angle, if it be applied horizontally, fixing it at a variable angle with the ribs becomes a matter of necessity. To obviate the difficulty referred to, some persons stand behind the patient while percussing the upper anterior regions: but when this plan is followed, it becomes as difficult to fix the finger on the left side, as on the right when the physician stands in the usual way in front of the patient; the position is besides open to several other manifest objections.

155. Valuable information may sometimes be obtained by using the four fingers of the left hand, laid firmly and closely on the surface, as a pleximeter. When the anatomical cause of variation of sound is considerable in extent, but slight in degree, there is an obvious advantage in including a space of some size under the pleximeter.

156. Whatever be the pleximeter used, the fingers are commonly employed as the percussing agent. The various hammers and accompanying apparatus, invented in this country and abroad, some of them of an appearance to terrify a timid patient, do not seem to me to possess any kind of superiority to the fingers, and labour under the serious disadvantage of depriving the observer of the indications furnished by the sensation of resistance of the parts percussed. The clinical supremacy of the fingers has never been seriously threatened by any of these elaborate inventions; and it appears consequently unnecessary to describe them.* Generally speaking, the index and median fingers, having their points placed upon exactly the same level, and supported, or not, by the thumb with its ball laid upon the outer surface of the former, opposite the articulation of its second and third phalanges, make the best instrument for striking with. But the index-finger alone may be

* However, some practical observers prefer the hammer; and, on the principle of *non est inanis pueri*, I would refer the reader to a valuable paper by Dr. Hugar, Bennett, in the "Edinburgh Monthly Journal," Oct. 1850.

used, especially when gentle percussion only is required, and generally, therefore, in the case of children. Under some circumstances three fingers form a useful modification; or the knuckle of the index-finger—that is, the joint of the first and second phalanges—may be used with good effect; in percussing the larynx, the most convenient plan is to fillip with the median finger.

157. When the four fingers of the left hand are used as the pleximeter, those of the right form the best agent for percussing with. If precision be desirable, the tips of the fingers should be used to strike; in rough examinations the palmar surface of the right-hand fingers, held in firm extension, may be lightly tapped against the dorsum of the left hand.

158. In the case last referred to, the percussing fingers are made to fall horizontally, the more accurately so the better, upon the surface struck; under all other circumstances, it is of essential importance that the points of the fingers fall perpendicularly upon the pleximeter. The least variation in this respect will assuredly be attended with a difference in the sound elicited.

159. In the act of percussing, *the movement should spring from the wrist only*, the fore-arm and arm being held perfectly motionless. The pain which beginners cause the patient in many cases, and the uncertainty of the results obtained, in a great degree depend upon ignorance of the real value, or neglect, of this rule: the awkwardness of striking from the elbow, or even the shoulder, as is often done, is a matter of less moment; though an observant patient will scarcely fail to be impressed unfavourably by it, when he finds himself rather pushed about than percussed. But the essential advantages of this mode of percussing are the nicety with which the force of the blow may be regulated, and hence made precisely equal in any two places it is the object to compare; and the great comparative ease of keeping the percussing fingers at *the same angle* in striking repeatedly the same or different spots. Were this point of manipulation generally attended to, it would be infinitely less common, than it now is, to hear a new and different sound elicited by each of a number of successive blows upon the same place;—a variation, the mere possibility of which constitutes a serious drawback to the utility of percussion as it is too frequently practised.

160. The force used in striking should never be great, absolutely considered; but it may be made to vary from the most gentle, to a smart tap, according to the object in view. Generally speaking, gentle percussion is advisable, when we desire to ascertain the

amount of density of superficial parts ; forcible, when deep-seated tissues are the subject of investigation. Corresponding regions of the chest, which yield sounds of the same resonance and duration when gently struck, may yield sounds materially differing in these respects if forcibly percussed, and *vice versa* ; it is therefore obvious, that both modes should be employed in every instance where accuracy of diagnosis is aimed at.

161. The blow should be quickly and lightly given, the fingers being withdrawn, or at least all pressure removed, the moment their impulse has been effectually communicated to the surface struck ; the vibrations of the surface are thus impeded to the least possible amount. To this precept there is but one exception : in eliciting a particular modification of special character of the sound (*cracked-metal character*), the successful production of which depends materially on the manner of striking, it is advisable to give the impulse slowly and heavily, and allow the fingers to press forcibly on the part for some moments after it has been given.

162. In the state of health the posture of the patient (except in so far as it may interfere with the act of striking on the part of the physician, or alter the tension of the patient's own muscles, or the relative position of the subcutaneous tissues,) does not *directly* affect the results of percussion of the surface, wherever this corresponds to lung-substance. In other words, ordinary (as distinguished from artificial [163]) changes of posture have no notable influence in modifying the relationship of the lungs and their containing walls to each other, or in altering the amount of air they contain, or are capable of containing. But as variation of attitude very sensibly alters the position of the heart, either in a downward, forward, or sideward direction, and also of the liver, the posture of the patient must always be taken into consideration in estimating the results of pulmonary percussion near the cardiac and hepatic regions.

163. The posture of a patient undergoing percussion should, where circumstances admit of this, be the sitting or the standing. The difficulty of placing the patient perfectly level in bed (and if he be not so placed, the sound on either side is extremely liable to be modified), together with the constrained positions the physician is obliged to place himself in, in order to get at different parts of the chest, constitute so many objections to the recumbent posture.

While the anterior regions are under examination, the patient, if examined in the sitting or standing postures, must hold his head

erect, and allow his arms to hang loosely by his side; his hands may be clasped across the head, to facilitate percussion of the lateral regions; and he should cross his arms pretty tightly in front, and bend his head slightly forwards while the back is examined.*

Where muscle of any thickness covers the part examined, it should be in a relaxed state, so as to facilitate as far as possible the close approximation of the pleximeter to the proper wall of the chest. The converse is the case when immediate percussion is employed; for the obvious reason, that a flaccid mass of muscle, in itself non-vibratile, must, besides, interfere with the transmission of sound from the subjacent parts.

164. It is scarcely necessary to insist upon the importance of observing, as far as possible, the same conditions, when percussing the two sides of the chest comparatively. Nor must it be forgotten, that in doubtful cases, the observation should be repeated many times and in various postures,—more especially, if the patient be in bed, the percussion should be performed several times from the right and left sides of the bed alternately. On the other hand, it is of essential consequence in some cases—for instance, in percussing the heart—that not only the posture of the trunk be unchanged during examination, but that the limbs be kept perfectly quiet.

165. I know of no evidence tending to prove that percussion-sounds of the chest are reinforced in its interior. Very probably they are. But on the other hand it is easy to ascertain that those sounds are, like other varieties of sound, capable of being deadened or reinforced according to the nature of the material with which the cavity giving them forth is in connection at the moment it is struck. Percuss a patient standing upon any ordinary carpeted floor; repeat the process, having previously caused him to lie flat on a well-stuffed spring couch (the percussion-sound of which, be it remarked *in transitu*, often most closely resembles that of a healthy chest): the mass of tone is much greater and its pitch distinctly lower under the latter than the former arrangement. Various shades of differences may be detected by percussing the body extended on the floor, on a table, on a marble hearth stone, &c. These results are distinctly dependent on reinforcement by unison-resonance on the part of the material used as the *quasi* sounding board.

* Vide a paper by Dr. Corson, of New York ("Med. Times," May 14, 1859), recommending a variety of other postures.

§ I.—PERCUSSION IN HEALTH.

166. The properties of the percussion-sound of the healthy thorax vary materially in its different regions. The main clue to these differences has already [146] been pointed out in the varying proportions of air and solid material falling within the influence of the blow struck. The greater the body of healthy lung beneath any spot (because hence the greater the relative quantity of enclosed air), the lower will be the pitch, the longer the duration, and the softer the quality of the sound that spot emits under percussion. The only exceptions to this rule arise from the difference in physical constitution of the chest-wall itself in its different parts, illustrations of which modifying influence will appear as we proceed. Hence it is, too, that individual chests have their individual resonance,—scarcely any two possessing exactly the same relative amounts of lung-substance and solid material in their walls.

167. *Anterior Regions.*—It is necessary to assume a standard of comparison for the sounds in different localities, and that of the infra-clavicular regions may be used for this purpose. Here the resonance is of considerable intensity, true pulmonary quality and pitch, and sufficiently prolonged to have a distinctly appreciable duration, while the parietal resistance is moderate, and the elasticity marked. The pitch is slightly lower at the acromial than the sterno-clavicular angle [10], gradually rising from the former to the latter spot,—and lower also at the second space than the first rib [102].

168. In the right mammary region, even at the upper edge, the pitch rises perceptibly, though slightly, on firm percussion; while at and below the fourth interspace, though pulmonary resonance may be elicited by a gentle tap, very perceptible elevation of pitch, with slightly increased resistance and diminished mass of tone, is caused, if the blow be firm, by the presence of the liver behind the shelving border of the lung: at the sternal edge of this region the heart in the majority of persons produces similar effects on the sound and resistance. In the inner part of the corresponding left region the mass of the heart plays a precisely similar part, greater only in degree, in modifying the percussion-note,—extending its influence as far outwards as, or, with a firmly-given blow, beyond, the nipple.

169. The resonance of the right infra-mammary region, in consequence of the presence of the liver beneath the surface, is high-

pitched, brief, hard in quality (if the hepatic tissue be indurated the quality may be wooden [140]), and accompanied with strong sense of resistance. The left lobe of the liver also exercises a similar influence on the inner part of the left corresponding region; while the outer portion is in like manner affected by the spleen, and the intermediate space gives either an amphoric and ringing or a tympanitic note from the subjacent stomach, if that viscus contain no solid or fluid material,—a short toneless noise, if it be full of food. On deep inspiration a certain amount of lung encroaches in front of the liver superiorly, and may be discovered by very gentle percussion; even in expiration some lung-substance may be similarly detected in the left region, unless the stomach happens to be greatly distended.

170. Both clavicles towards their sternal ends give a peculiar sound of mixed pulmonary and osteal characters, rendered somewhat tubular too by the immediate vicinity of the trachea; about the centre of the bone the tubular and osteal characters become less, the pulmonary more, marked, the pitch falling perceptibly. Towards the humeral end of the bone the note again rises in pitch, and its quality becomes hard, but non-tubular.

171. In the supra-clavicular regions, at their outer part, the resonance has much the characters of the first interspace; the pulmonary quality, especially in females and young males, is quite as obvious as below. The pitch rises at their inner part, where a slightly ringing and tubular quality is also elicited, unless the blow be directed so as to avoid the trachea completely. The grave-toned resonance of this region may, in moderately thin persons, be retained even a little behind the anterior edge of the trapezius muscle. On the other hand, in individuals free from thoracic disease, but either naturally very thin or emaciated from any disease, the outer part of this region often gives resonance of wooden quality under percussion, and is very resistant; the first rib forms, as it were, the floor of the region, and its proper osteal tone comes out only very slightly modified by the thin intervening soft parts.

172. The supra-sternal region gives distinctly tubular resonance, if the percussion be made at right angles with the surface; a mixture of osteal sound is detected, if the impulse be given even to a slight degree in a downward direction. The proximity of the trachea and sternum explains this. In the upper sternal region the resonance is of the same mixed quality, as on the adjoining end of the clavicle, as far downwards as the second rib; here, at

the point of convergence of the inner borders of the lungs, especially at the moment the organs are distended by inspiration, purer pulmonary tone may be elicited by gentle percussion. But occasionally, from excess of cellulo-fatty substance at the top of the mediastinum, the percussion-sound may be hard in quality and high-pitched here,—a peculiarity which sometimes proves a source of serious clinical difficulty.*

173. From the third rib downwards the resonance is of complex character. The heart and liver with the intervening diaphragm give a toneless sound, modified, however, by the peculiar bone-resonance of the sternum itself. If the stomach be in the condition to yield either an amphoric or a tympanitic note, one or other of these qualities may be detected, modifying still further the intrinsic sound of the solid organs. This region further presents one of the most difficult practical problems in the art of percussion,—that of defining the line of union of the heart and liver. Now, although there are cases where, to a practised ear and finger, the differences in the pitch of the sound and resistance of the two organs (the former being graver and the latter less marked over the heart than the liver) will effectually mark out the conterminous edge of each of them, instances of the kind are not the most usual,—obviously because, one of the organs somewhat overlapping the other, the percussion-note there must be a resultant of that furnished by the substance of both. These characters failing, the line of demarcation may in many persons be traced by making gentle and forcible percussion alternately, while the patient holds his mouth widely open: the special amphoric quality of the stomach-note may then be detected between—and only between—these two organs. I have repeatedly proved this on the dead subject. But even this test will—sometimes from solid or fluid accumulation in the stomach, sometimes from unusual position of the viscera—wholly fail; the line can then only be found by uniting hypothetically the lowest point of the heart's impulse with the apex of the angle formed by the union of the upper free edge of the liver with the right free edge of the heart.

174. *Posterior Regions.*—The supra-spinous fossa (in spite of the mass of muscular substance filling it, and the imperfect apposition of the bony stratum of the scapula with the chest-wall beneath) gives a note in healthy persons, even though they be

* It may simulate, according to circumstances, the abnormal percussion-note of pericardial effusion, aneurism or tumour, as will hereafter be fully shown.

fat, by no means deficient in the graveness, the body of tone and soft quality characteristic of normal pulmonary resonance. In thin females, especially, the note is sometimes very strikingly pulmonary.

The lower scapular region, while less resonant and of higher-pitched tone than the upper, and resisting to a marked degree the impulse of the fingers, has some faint pulmonary character in both respects; the spine of the bone, on mediate percussion especially, gives a high-pitched ostal sound. The inter-scapular region holds an intermediate place in point of resonance between the upper and lower scapular.

175. The entire of both infra-scapular regions, especially in inspiration, gives a well-toned pulmonary note on gentle percussion as far as the eleventh interspace downwards. But forcible percussion on the right side brings out the high-pitched, hard, hepatic sound from the lower edge of the region, as high as the ninth or even eighth rib, the amount of these characters gradually decreasing in the upward direction.* On the left side, the spleen, if large, or the stomach and intestines, modify the percussion-sound of the lung, at the lower part of the region. Speaking roughly, it is certain, the extreme right posterior base is less resonant, and its tone slightly higher pitched, than the left. The influence of the kidneys, when of natural size, is practically null.

176. *Lateral Regions.*—The axillary region is highly resonant in its upper part, giving in many persons a sound graver, softer, louder, and of greater duration than the infra-clavicular region. On the right side the sound loses in amount and rises in pitch on strong percussion at the fourth interspace, and acquiring the same characters at the sixth rib, as in the infra-mammary region in front [173], retains them thenceforth to the lower border of the infra-axillary region. Below the sixth rib on the left side, though pulmonary resonance may still be elicited by gentle percussion, the spleen and stomach modify in their respective ways the characters of the sound.

177. *Larynx and Trachea.*—Lastly, the sound elicited from the larynx and trachea (which is best obtained by flapping with the right middle finger one of the fingers of the left hand applied firmly to the surface, the patient's head being thrown back, and the tissues of the neck thus brought into a state of tension),

* The blow must really be forcible, however, to bring out liver-note so high as this.

notably higher pitched than the pulmonary tone, is loud, of considerable duration, and has a distinct hollowness in its quality, — is in fact tubular. These characters arise from the form of the tube and the quantity of cartilage in its walls. The resistance is greater under the fingers, in proportion to the mass of sound, than it would prove over healthy lungs.

178. The properties of the sound elicited by gentle and by forcible percussion differ to a slight or to a marked degree in all regions of the chest independently of difference in the density of the structures beneath. When strong percussion is used, the percussing fingers, by a sort of mechanical necessity, are allowed to rest on the surface for a moment; and thus a muffled character is given to the sound from interference with the vibrations of the chest-walls. Hence, force in the blow, instead of intensifying, weakens the sound and lessens its duration. Again, wherever an organ of greater density than the lung lies at some depth from the surface, the intervening space being occupied by pulmonary tissue, the sound will be raised in pitch and lessened in amount, by striking heavily, its duration diminished, and the sense of resistance increased: by employing force, the impulse is made to reach the deep-seated organ. For this reason a decrease in amount of tone and rise in pitch may, as we have seen, be sooner detected by strong than by gentle percussion, in passing from above downwards in the right lateral and anterior regions; the influence of the liver is thus brought into play at a higher point of the chest. On the same principle the precise extent of the heart overlapped by the lung may be defined by alternately using some force, and by merely tapping the surface.

179. The sound is louder and of harder quality on the ribs than the intercostal spaces; this is especially true in thin persons, — the osteal note mixes with the pulmonary, and also raises the pitch of the resulting compound sound. So, too, the tone is harder in quality and higher in pitch, as a rule, over the angles of the ribs posteriorly, than in the vertebral groove.

180. *Regional Differences of Pitch.* — A rising gradation of pitch from grave to acute, changing at irregular intervals, it is true, may be traced in the antero-lateral regions, as follows: — stomach region (the graver the note the more that organ is distended with gas); the axillary region; the second interspace; the post-clavicular region; the third space; the fourth space; the mid-top of the sternum; the clavicle; the centre of the cardiac region; the liver [113].

181. The acts of inspiration and expiration modify the results of pulmonary percussion in three different manners: *a.* by altering the volume of the lungs; *b.* by altering their density; *c.* by altering the position of the heart and abdominal viscera.

182. *a.* At the close of an ordinary expiration the right lung extends downwards as far as the sixth rib in front and the eighth laterally. The lower edge of the left organ sloping abruptly outwards and downwards from the middle line on the level of the fourth cartilage, again turns inwards a little, and then passes outwards, reaching laterally the eighth rib or interspace. From numerous trials on the dead subject, where no cause existed to modify materially the volume of the lungs, I infer that in expiration the lungs lie from one to one and a half inches apart on the level of the second cartilage, and four and a half inches apart on the level of the fifth. From their lateral aspect the lower edges curve downwards and backwards, reaching the ninth interspace or tenth rib, especially close to the spine.

183. During full inspiration the lungs extend downwards in all directions materially further than the limits just mentioned; their inferior edge is then carried about an intercostal space and a half lower than after ordinary expiration; whereas, by forced expiration that edge is sensibly raised. The play of the lower border of the right lung on the vertical line of the nipple may range between the fifth and the seventh ribs or interspaces,—a distance averaging in chests of medium height about three inches. In the measure of this distance (determined by gentle percussion and by vocal fremitus) we have an excellent test of the “total breathing-volume” [122] of the right lung. So, too, the breathing play of the anterior margin of the left lung may be determined by its varying amount of encroachment on the area of the heart’s superficial dulness in inspiration and expiration.

184. It is obvious, from these facts, that the *superficial extent* of surface, from which pulmonary percussion-sound may be elicited, will vary with the precise moment of the respiratory act at which the observation is made.

185. *b.* In regions of the chest, say the infra-clavicular and axillary, where a large body of lung lies beneath, a sensible difference in density marks the entry or exit of the “total breathing volume” [122] from the part. At the end of forced expiration the percussion-note is higher in pitch, harder in quality, shorter in duration, and inferior in mass of tone to that producible at the end of full inspiration. The sense of resistance increases, at the

same time, the more complete the expiratory emptying of the lungs. Nay, even in the ordinary movement of the tidal air [122] differences the same in kind, though greatly less in degree, may be occasionally caught, where the lungs are thoroughly sound.

186. *c.* The fall in position of the dense spleen and liver attending inspiration, replaced as they are by expanding lung, tends during that act to increase the amount of pulmonary character in the percussion-sound in the lower regions of the thorax; the influence of the similar locomotion of the stomach and intestines will vary with the filled or empty state of those viscera. The heart pushed downwards and inwards, and receding somewhat from the chest-wall during inspiration, where its place is taken by the inflated lung, gives its peculiar high pitched and relatively hard resonance within an area smaller in size and lower in site during that act than in expiration.

187. In consequence of this triple influence of the respiratory movements on the results of percussion, it is advisable, under all circumstances, and absolutely necessary in delicate cases, that the act of respiration be at the same stage of progress, when the two sides of the chest are percussed comparatively. The end of a full inspiration is in such instances the fittest moment for striking; as, by desiring the patient to hold his breath, we may then be certain of having both lungs in the same state for a short while.

§ II.—VARIATIONS FROM THE STANDARD OF PULMONARY PERCUSSION COMPATIBLE WITH A HEALTHY STATE OF THE LUNGS AND PLEURA.

188. The sound yielded by the chest of different individuals varies in characters. In some instances this is explicable, in others not so. The thinner the walls, as a general rule, the greater the mass of tone, the graver the pitch, and the more pulmonary the quality of the percussion-note; in all these attributes the note improves in persons whose thoracic walls emaciate independently of pulmonary disease. On the other hand unusual laxity of the ligamentous structures of the thorax renders the walls unfavourable to vibration. But, making all allowance for these conditions, there will still remain instances in which the chest is unusually well- or ill-sounding, without its being possible to assign any satisfactory cause for the peculiarity. The real existence of such cases, however inexplicable at present, should always be borne in mind by the clinical observer.

189. Sex has its influence: the sound is relatively more pulmonary in all its attributes in females in the upper regions, especially the supra-clavicular, as contrasted with the lower, than in males. The relative amounts of movement of the tidal air superiorly and inferiorly in the two sexes, give a satisfactory clue to the difference [49].

190. The sound varies, too, with period of life. From the age of four or five to fifteen the pitch is grave, the duration marked, the quality soft, resistance slight; the walls are flexible, elastic, and commonly not much loaded with soft textures. The ossification of the cartilages, desiccation of the ligaments, and general stiffness of the thorax in old age impairs the freedom of vibration, and *pro tanto* lessens the resonance: while the excess of hardness in the chest-wall thus induced tends to raise the pitch and annul the healthy softness of quality of the percussion-note. These latter effects would probably be much more generally observed, were it not for the counteracting influence of senile atrophy of the parenchyma of the lung and wasting of the external soft parts.

191. Marked deformity of the chest, congenital or acquired, modifies the resonance over lung, healthy in itself. Lateral curvature of the spine will destroy the pulmonary quality in the direction where it bears. Many of the physiological deviations from symmetry, described by M. Woillez [31—35], also variously influence the percussion-results,—their general tendency being to raise the pitch and harden the quality of the sound. The existence of broken ribs, too, impeding freedom of motion on the affected side, and hence lessening the quantity of air in proportion to the pulmonary substance beneath, induces the effects on the percussion-note entailed by increase of density [146]—a fact showing that slight diminution of resonance does not, after an injury of the kind, positively prove the existence of pulmonary hæmorrhagic or exudative infiltration.

192. Numerous differences in the results of percussion of corresponding points of the two sides of the chest have been noticed, and traced to an obvious cause,—the presence of texture and organs of different densities in those spots. Variable thickness of the external soft parts will have a similar effect; thus the right infra-clavicular region is less resonant than the left in robust persons whose employment requires much use of the right arm: the pectoralis muscle enlarges from use. Here the explanation is obvious; but the explanation is not obvious when the right infra-clavicular region emits less tone than its fellow, in persons

presenting no muscular thickening of this kind.* Such inferiority of resonance (sometimes attended, too, with slight elevation of pitch) is never great, provided the lungs be perfectly healthy; it holds good, whatever be the direction given to the percussing fingers, and whether they fall outwards towards the humerus or inwards towards the sternum.

The pitch is higher and the quality harder in some individuals at the left than the right sterno-clavicular angle.

§ III.—PERCUSSION IN DISEASE.

193. Whatever be the nature of the morbid conditions of the sound discovered in any case, the area within which they exist, like that of the unhealthy textural state causing them, may be either sharply defined or not. In the former case there is no difficulty experienced in ascertaining the precise limits of the diseased part; in the latter, there often may be some indecision on the point, and it will be found useful to glide the pleximeter-finger rapidly over the entire region under examination, continuing the percussion all the time it is moved. In this way the exact line at which change of resonance begins may be detected in difficult cases.

I.—ALTERATIONS OF SOUND.

A.—STATICAL SIGNS.

194. As the percussion-note possesses four distinct properties,—intensity, pitch, duration, and quality,—and, as any single one of these, or any number of them in association, may be altered independently of any very marked change in the remainder, it follows the possible combinations in disease are very numerous. But the varieties, possessed of practical significance, are few, and may be grouped under four typical heads. These are tabularly exhibited in the subjoined plan:—

Types of morbid resonance.	Intensity or mass of tone.	Pitch.	Quality.	Duration.	Resistance.	Corresponding physical state.
Type 1.						
<i>Toweliness or Dulness.</i>	Diminished.	Raised.	Hardened.	Lessened.	Increased.	Air diminished; soft consolidation or fluid present.

* Clinical Lectures, Lancet, loc. cit., p. 196, 1849.

Types of mor- bid resonance	Intensity or mass of tone.	Pitch.	Quality	Duration.	Resistance.	Corresponding physical state
Type 2.						
<i>Extra Reso- nance.</i>	Increased	Lowered.	Softened —more or less ap- proaching tympanic.	Increased.	Decreased.	Moderate ex- cess of air.
Type 3.						
<i>Harshness.</i>	Not sensibly changed may vary.	Raised.	Hardened — or still further modified [265].	Not sensi- bly changed.	Increased.	Air diminished; —hard consoli- dation.
Type 4.						
<i>Muffled tone.</i>	Diminished.	Lowered.	Annulled.	Lessened.	Increased; of pecu- liar cha- racter.	Great excess of air, with pa- rietal tension.

195. *Type 1.*—Diminution of intensity, resonance, and mass of tone (gradually passing into more or less complete tonelessness,—so-called dulness) accompanied with elevation of pitch, loss of the normal soft pulmonary quality, and shortening of the sound, occurs in a certain proportion of cases where the density of the materials, under the part struck, is increased.* Thus, deficient resonance with these accompaniments exists to various amounts: *First*, where new material of greater density than lung and air, combined in the natural relationship, has accumulated within the chest: whether it be in the lung proper, as in the engorged and hepatized stages of pneumonia, abscess, gangrene, serous infiltration, apoplexy, simple chronic consolidation, infiltration or tuberculous accumulation of exudation-matter, tubercle or cancer within the parenchyma;—or in the pleura, as in cases of hydro-thorax, and (at the lower part of the chest) hydropneumo-thorax, hæmo-thorax, pleurisy in the periods of exudation, effusion, and retrac-tion, empyema, serous infiltration of old false-membrane, and solid adventitious products of all varieties;—or in the bronchi, as in cases of abundant muco-purulent accumulation within the tubes;—or in the mediastina, as in cases of hypertrophy of their areolo-fatty tissue, enlarged bronchial glands, abscesses, and adventitious solid products. *Secondly*, such deficiency of resonance arises where any condition, either statical or dynamic, exists, favouring expiration and impeding inspiration: as in obstructive diseases of the upper air-passages, spasm of the glottis, and spas-modic asthma,—in the latter affection the presence of pulmonary

* Some apparent exceptions will be discussed by and by [199]

emphysema often prevents the defect of resonance from being discovered. *Thirdly*, dilatation and thickening of the bronchi, condensing the adjacent parenchyma, produce a similar effect. Further, serous infiltration of the parietes, abscesses, tumors,* soft osteo-phytic enlargement of the ribs in chronic empyema (U. C. Mus. No. 4067), and thickening of the costal periosteum in syphilitic persons, will deaden the sound and raise its pitch. The influence of the heart and great vessels will be elsewhere considered.

196. Deficiency of resonance does not vary in amount or in attendant characters according to any known laws, determined by the pathological nature of its cause. It may be affirmed, however, that extreme tonelessness with greatly heightened pitch and strong resistance goes far sometimes towards establishing the diagnosis in cases of intra-thoracic tumor. Between this extreme and the opposite one of slight impairment of sound in spasmodic asthma, all shades of difference may be observed.

197. *Type 2.*—Increase in the mass of percussion-tone, fall in its pitch, and increase in its length, while the quality grows even softer than that of health, and the resistance under the fingers decreases, are noted, when the relative quantity of air within the chest is increased, either generally or locally. The type belongs to diseases which may be familiarly called rarefying,—except under peculiar circumstances to be presently (Type 4) considered.

Here may be enumerated pneumo-thorax, hydro-pneumo-thorax, atrophy and emphysema of the lung, pulmonary hypertrophy, too, if accompanied with cell-distension. And extreme anaemia, probably by lessening the relative quantity of blood in the lung, may, as originally suggested by Dr. Stokes, produce the present type of morbid resonance.

198. This type comprises all cases of true tympanitic resonance,—that is, the term being understood to signify (as it always does in this work) pulmonary resonance exaggerated, and resembling that of a drum.

199. *Type 3.*—Heightened pitch, quantity of tone commonly not sensibly changed, while the quality becomes hard, wooden, or even tubular [208], is a combination frequently met with in certain conditions of induration of the lung-substance. It is, perhaps, the most frequent state of the percussion-sound at the

* Cancer of a rib producing this effect in the interscapular region, — case of Jennings, U. C. H., Females, vol. xv. p. 65, 1859.

apices in early tuberculisation. This type, again, is observed where there is a surplus of air in the subjacent part, with considerable induration of tissue between the surface and the part containing that surplus,—a combination of conditions met with where a superficial cavity in the lung has a thin, indurated, and adherent wall; or where dilated tubes are surrounded by very hardened tissue, as in pulmonary cirrhosis.

Not only may the amount of sound in percussion notes of this type not be lowered below, but it may be actually raised above, the normal standard. This fact is perpetually illustrated by the resonance of tuberculised apices, and is one of the sources of error in physical diagnosis that most readily entraps the careless manipulator.

200. *Type 4.*—Numerous observers have noticed that in cases of pneumo-thorax the resonance, originally of Type 2, occasionally changes wholly in the progress of the disease. The change is connected with extreme distension of the pleural sac, and is characterised by diminished intensity of resonance,* fall in pitch, loss of distinctive quality, and lessened duration. M. Woillez, correctly distinguishing this tonelessness from ordinary so-called dulness, invents for it the title *obtuseness* of sound,—the phrase *muffled tone* will perhaps convey the idea. The resistance is very peculiar in character,—suggestive of extreme tension and thinness of the resisting material.

201. Distension of the pleura with air being the admitted cause of the exaggerated resonance of Type II., why does the tympanitic quality become less marked, when air-distension reaches an extreme point,—when, in other words, the cause appears increased in amount? Whatever be the explanation, a similar phenomenon is observed in the drum; if a drum be tightened to the extreme point possible, and all escape of air from its cavity prevented, its sound, when struck, becomes muffled, toneless, almost null. Some maintain that the excessive stretching of the chest-walls or drum-heads impedes their vibration, in conformity with results obtained by Savart on the vibration of tense membranes; others, that the walls becoming vibratile when stretched to the maximum, their vibrations interfere with those of the contained air, and so nullify the sound, which is really and solely produced by that air. It may be that the mere size of the pleural sac has something to do

* Plympton, U. C. H. Males, vol. iv. p. 410. I believe Skoda to have been the earliest person who put the fact on printed record.

with the phenomenon; an aperture is essential to sonorous vibration in large hollow instruments, whereas the vibrations of the air in small cavities are said to be soniferous, although perfectly closed: it is doubtful, however, that the difference in capacity of a moderately and a greatly distended pleural sac is sufficient to warrant this solution. M. Woillez (maintaining that the diminution of sound has nothing to do with increased tension of the walls, inasmuch as the more compact the chest-wall, the more intense the sound*) suggests that, as by gradually distending to extremes a hollow organ with air, the pitch is lowered and the sound lessened, the sound in the cases of pneumo-thorax under consideration is diminished simply and alone from excess of gravity.

202. Another strange fact is, that over different parts of the same air-distended side may be heard by percussion amphoric note with metallic echo, true tympanic note and the muffled type of resonance or obtusion, just discussed.†

203. But, in addition to forming an element of these morbid types of percussion, pitch and quality may be either solely, or so predominantly, affected, as to constitute the essential morbid condition.

204. *Alterations of pitch* rarely exist unassociated with other changes. Slight sharpness of tone at the apex in commencing tuberculation (and even here there is coexistent increase of resistance of the part percussed) is the only useful example I can adduce. This sharpness may, I conceive, depend on connected congestion of the part,—the rapid changes it occasionally presents under treatment seem otherwise inexplicable.‡

205. *Changes of Quality*.—Instead of the quality *sui generis* which distinguishes the natural sound emitted by the chest, others, assimilable to those of various well-known tones, exist in certain states of disease. These morbid varieties of quality may be arranged thus:—

- | | |
|--------------|---------------------------------|
| (1) Hard . | Wooden |
| (2) Hollow | { Tubular |
| | { Amphoric. |
| (3) Tympanic | { cracked jar or Cracked metal. |

* In illustration M. Woillez compares the great resonance of the ribs with the resonance of the interstices. But he here seems to misread muffled quality and quality of sound with amount of sound. He forgets, too, the difference of the material of the ribs and the interstices.

† See also, J. C. H. Miller vol. vii. p. 169, 1859.

‡ A striking example of this rapidity, considering the nature of the disease, has

206. (1.) The healthy softness of pulmonary resonance is very easily lessened by consolidating diseases: the resulting hardness eventually passes into the *wooden* quality,—closely resembling that of the sound yielded by mediate percussion of a deal table, and distinctly conveying the idea of hardness. The duration of the sound having this quality is commonly less, the pitch higher, than in the natural state, and the sense of resistance experienced by the fingers unusually great.

207. (2.) The *hollow* quality occurs under three varieties,—the tubular, amphoric, and cracked-metal.

208. The *tubular* quality is precisely like that of the resonance emitted by the trachea under mediate percussion. The sound it characterises is of some duration, and the thoracic elasticity somewhat impaired. This quality is to be detected (always more readily if the patient's mouth be kept open) about the inner part of the infra-clavicular region in cases of pleuritic effusion, occupying the lower parts of the chest,—sometimes during the height of the disease, unless the quantity of fluid be enormous,—sometimes when absorption has just commenced; sometimes in the stage of retraction of the same disease. So, too, when solidified lung, pent-up collections of pus, or solid products of any kind lie between the large bronchi and the costal surface, the sound acquires, or may acquire, this quality. Mere dilatation of the bronchi will have the same effect. Sound of this quality is most common in the infra-clavicular and upper mammary regions; but it may occur in the inter-scapular region from enlarged bronchial glands,* or over a great part of the back in cases of intra-thoracic tumour.† Excavations in the lung of small and medium size may furnish similar resonance.

209. The *amphoric* (from *amphora*, a jar) quality, the tubular on a larger scale, is heard in typical perfection in the sound produced by tilting the cheek, when the mouth is closed and fully, but not too tensely, inflated,—and also in the abdominal percussion-sound in certain states of distension of the intestines. I have observed this perverted quality over the entire upper front of the chest, including the clavicle and first bone of the sternum, in a few cases of pleuro-pneumonia, and in as great perfection as it is ever heard over the intestines. When of this origin, the sound

already been referred to (p. 49, note *); but an appreciable fall in pitch may sometimes be traced *day by day* during the resolution of pneumonia.

* Petrolini, U. C. II., *Females*, vol. v. p. 176. Here the tubular quality, distinct on gentle, disappeared on strong, percussion.

† Nature and Treatment of Cancer, case of S. C., p. 362, 1840.

does not last long. But the common source of the sign is a cavity of large size, near the surface, and provided with hard and thin walls. Here, as also in pneumo-thorax,* it may be followed by a metallic, almost tinkling, vibration.

210. The *cracked-jar* or *cracked-metal* quality (*bruit de pot fêlé* of Laennec) somewhat resembles that of the sound resulting from striking the back of the hands, loosely folded across each other, against the knee,—the contained air being forced out quickly and abundantly between the fingers at each blow. When this character modifies the percussion-sound of the chest, there is coupled with it almost invariably a good deal of the amphoric quality, and the combination gives a result altogether *sui generis*, which, once heard, cannot easily be forgotten. Let there be a pulmonary cavity of large size with anfractuous walls, and communicating freely with the bronchi, the corresponding parietes being at the same time particularly yielding, and percussion will elicit this variety of quality. It is commonly said to depend on the collision of liquid and air produced by the blow; but the sudden propulsion of air, forcibly expelled from the cavity, against the walls of the passages with which it comes in contact, seems sufficient to generate it. In the first place, cracked-metal resonance is producible over cavities, when free from fluid,—at least if the absence of cavernous rhonchus is to be trusted to as evidence. In the second place, if, as I found several years ago, the nose and mouth be tightly closed in a patient furnishing the cracked-metal sound when they are open, that character will at once cease to be producible, though percussion continues to give an amphoric note.† The fair interpretation of this fact seems to be, that the sudden rush of air from the cavity outwards, produced by the forcible blow upon the yielding parietes in the ordinary open state of the mouth and nose, but completely prevented by their closure (the only condition materially altered in the experiment), is the real cause of the phenomenon. Whether the communication with the external air be interrupted or not, the contents of the cavity may be dashed together by percussion: were the common notion correct, the cracked-metal quality ought therefore to be elicited in both cases. This explanation derives support from the conditions of production of the amphoric and cracked-metal sounds by striking the hands, closed

* *Lancet*, U. C. H., *Males*, vol. xvi. p. 145, 1859.

† It would be the same, if the breath be purposely retained; a patient with intercostal emphysema, ascertaining this accidentally, amused himself with investigating the bystanders, by sometimes having, sometimes not having, cracked metal resonance. — *Quod*, U. C. H., *Males*, vol. vii. p. 291.

so as to form a hollow, against the knee: if they be so closed as to prevent air from being forced from between them by the blow, the amphoric character only is detected,—if air be allowed to escape freely, the character analogous to the cracked-metal is superadded; yet here, certainly, there is no liquid to take part in its production. I have known a tubular note in pneumonia become distinctly cracked-metal when consolidation was at its height; and several instances have occurred to me of cracked-metal resonance under the clavicle of the affected side in pleuritic effusion. Now in both cases the forcible expulsion of air from lung-tissue *must* take part in producing the sound.

211. It has been well observed by Dr. Stokes, that a "metallic resonance, somewhat analogous to the cracked-jar sound of cavities, but evidently more diffused," is occasionally discoverable in cases of bronchitis, particularly in children. I have repeatedly observed this in infancy; it becomes especially likely to mislead, when there is evidence of tuberculous disease in extra-thoracic organs, as the brain or meninges.* The sound is certainly more diffused than, and otherwise different from, that dependent on excavation; but the absence of other cavernous phenomena, and the knowledge of the fact that bronchitis may simulate (for it does no more than this) the sound, are the best safeguards against error. The pliancy of the chest-walls explains the peculiarity.

212. If the chest of a crying infant be percussed in expiration, the resonance will be of cracked-metal quality, though the lungs are perfectly sound.†

213. (3) *Tympanitic quality*.—I reserve the title tympanitic for quality resembling that of a drum. By thus using the word in its etymological and popularly accepted sense and this alone, the confusion arising from the varieties of significations given it by authors will be avoided. The note is loud, long, grave: the accompanying resistance of the walls tense, drum-like, elastic. It is the quality of health exaggerated: Avenbrugger's natural pulmonary muffled-drum note minus the muffling.

214. The relationships of tympanitic resonance and pneumo-thorax have just been discussed [201]. In emphysema, with bulging of the chest, it is also occasionally observed, but never in the perfection attained in pneumo-thorax. Further, as was first noticed by that accomplished observer, Dr. Graves, the quality of the note over pneumonic consolidation, sometimes, temporarily

* Wright, *et. 4*; U. C. H., Females, vol. viii. p. 193.

† Bowen, *et. 4*; U. C. H., Females, vol. vii. p. 293.

becomes tympanitic: of this I have now observed two positive examples at the right base, in one with, in the other without, plastic lymph on the pleural surface; but they are excessively rare.*

215. The distinction of the amphoric and tympanitic qualities cannot be set aside practically, for they are absolutely different to the ear. Yet they are allied in mechanism. In the abdomen, for instance, a knot of intestine distended to the full with flatus will yield a sound of tympanitic quality; if the distension becomes less by the movement onward of some of the flatus, the sound will often instantly become amphoric: this holds true whether there be notable fluid or not in the spot. There are cases, too, in which the resonance partakes of both qualities,—I presume because the blows given affect portions of intestine differently distended.

216. In a moribund patient of Dr. Garrod's (U. C. H., Ward 7), to whom I was called accidentally in the absence of that physician, and in whom I found, in addition to the more ordinary signs of copious pleuritic affection, *amphoric*, not tympanitic, resonance at the upper and inner part of the side, extending across the first bone of the sternum, the post-mortem examination, a few hours later, proved the presence of several cubic inches of gas in the site of the amphoric resonance. Local pneumo-thorax, at all events at the upper part of the chest, may then give an *amphoric* quality to the resonance:—But as I have since found that in general pneumo-thorax the sound may be amphoric at the lateral base, tympanitic about the mamma, and toneless in the axilla [202], it is plain the contiguity of the trachea and large bronchi does not explain the amphoric quality in the case just referred to.

217. True tympanitic resonance is excessively rare over pneumonic consolidation;† and I have scarcely ever observed it at the upper part of the chest where pleural fluid had accumulated below. When such resonance occurs at the base of the chest, great distension of the stomach or colon might be suggested in explanation: but in point of fact, the stomach and colon are rarely distended enough for the conversion of their common amphoric into tympanitic quality: and in the only two positive instances I have observed of pneumonic tympanitic sound, the consolidation was on the right side above the liver. I am satisfied the pheno-

* I am doubtful, however, whether Dr. Graves, in using the term tympanitic, did not mean to designate the quality which I should call amphoric.

† Bishop, U. C. H., *Med.*, vol. ii. p. 124.

menon does not depend on temporary secretion of air by the pleural sac.*

218. On the other hand, tubular, or amphoric, quality is not very uncommon over parts acutely hepatized; is common on the level of chronic solidification; and is an almost unfailing attendant, at the apex regions, on pleuritic effusion at some period or other of its course.† What is the cause of this? Formation of intra-pleural air, only in rare and exceptional cases, such as that just referred to [216]; for unquestionably, unless under the influence of gangrene, or special alteration of the fluids, such formation is not admissible on any existing pathological principles.

219. An explanation of the infra-clavicular tubular note in pleuritic effusion, originating with Dr. Hudson, has generally been accepted in this country: he looks upon it simply as the natural note of the trachea and main bronchus conducted to the surface by the pushed-up and condensed lung. And I believe that the trachea does sometimes exercise this influence, just as it will where a mass of enlarged bronchial glands bridges the space between itself and the surface. But this explanation is utterly inapplicable to all cases: what light does it throw for instance on the occurrence of tubular note at the right posterior or lateral base?‡

220. Skoda regards the phenomenon as an illustration of the following law: if the lung contain less than its normal quantity of air, it yields a sound which either approaches to, or is distinctly, tympanitic. Skoda is unquestionably right as regards the matter of fact, provided the word be understood to mean tubular or amphoric,§ and the reduction of air be limited in amount. The effect will be the same whether the diminution of air depend on compression from fluid in the pleura, or on "an increase in the fluid or solid constituents of the lung itself."

221. But neither the explanation of this law, which has been offered by Skoda himself, nor the theory of annulled "Hallerian

* Vide art. Products, Adventitious; Cyc. of Anat. p. 145.

† My own experience would justify stronger language even than this. I have, in truth, never known pleuritic effusion run its course without infra-clavicular tubular resonance, in cases examined daily, *provided the apex were free from disease.*

‡ Tubular notes identically the same, may exist over fluid below and condensation above,—physical conditions so different. Ward, U. C. II., Females, vol. xi. p. 67, —*proved post mortem.*

§ Skoda actually does include under this term the tubular and amphoric as well as the true drum-like resonance. Singularly enough, he nowhere states what he himself precisely means by the word tympanitic.

Extension" of the lung, which M. Woillez (loc. cit.) seeks to introduce in its stead, seem to me at all satisfactory.*

The most intelligible rationale of the peculiar tone seems to be this. If the consolidating material within, or the compressing material without, the lung be not accumulated to such extent as to obliterate by external pressure the multitude of minute bronchioles within it, these tubes (like so many miniature tracheæ) give their special resonance, conducted by the quasi-solid or fluid material intervening, to the percussion-note on the chest-surface. If, on the contrary, the accumulation be sufficient to close up the fine tubes, the source of tubular sound is annulled; and the resonance becomes that of the consolidating material and consolidating lung-tissue combined,—that is, acquires the character of the toneless Type 1 [195].

But there still remains for interpretation an important point, namely, the constant extension of the tubular note beyond the area of the compressed lung (sometimes as far as the outer third of the clavicle on the other side), for which no one, as far as I am aware, has even attempted to assign a cause. Obviously it cannot depend on the compressed lung being pushed to the opposite side; besides, the respiration-sounds may be perfectly normal at the apex of that, the non-affected, side; hence the unavoidable inference that *the percussion-sound of a given spot may depend, not on the condition of the parts directly beneath, but of those more or less distant in the fellow half of the thorax.*

I am not acquainted with any hitherto recognised principle to which we can refer for explanation of this peculiarity. Now we have plainly to deal with an unusual effect of the sideward impulse produced by a vertical percussion-stroke. The waves of vibration of the parietes on the healthy side, produced under the direct influence of that stroke, extending in a sideward or horizontal direction, meet with some material that takes up the vibratile motion with unusual facility, and mingles the sound resulting

* At the post mortem examination of a case of acute tubercularisation and consolidation, the following singular facts were observed. "In the third and fourth right interspaces, close to the sternum, where amphoric percussion-note was so marked at the last examination during life (forty-eight hours before death), the resonance is now totally without amphoric quality. . . . About eight ounces of serosity in the right pleural sac—entire right lung solid, bearing on its surface the impress of the ribs. . . . Corresponding to site of amphoric resonance in front, the lung is thoroughly solid and cuts almost crisply; this portion of the lung lies over the main bronchial tube, which, how-
ever, lies deeply. . . . At the posterior aspect of the lung, about three inches from the apex, close in towards the spine, and at about half an inch from the surface, is a cavity capable of lodging a walnut." Hodson, U. C. H., *Males*, vol. ix. p. 15.

from its own vibration with that of the spot struck. For this phenomenon, of which some striking examples are to be found in connection with the heart also, I would propose the title *horizontal impulse and conduction*.

222. Meanwhile the practical truths in the matter may be fixed on the student's mind by the following tabular arrangement :

PERCUSSION-SOUND OF

Intestine, containing		Lung, containing
Medium amount of air . . .	Slightly tympanitic; pitch medium	Muffled tympanitic (normal); pitch medium.
Little air . . .	Amphoric; pitch rises.	Amphoric; pitch rises.
Extremely large amount of air . .	Tympanitic up to toneless; pitch falls.	Tympanitic up to toneless; pitch falls.

223. *Moveableness of area of morbid percussion-signs.*—The superficial extent and locality of percussion-changes, important guides to the detection of their cause, will be dwelt upon in the description of individual diseases. The present is, however, the place for the general statement that the area, within which loss of resonance is detected, may either be *fixed*, or *changeable with the position of the patient*. The former is by far the more common case; no matter how the posture be varied, the line of demarcation of the naturally and morbidly sounding parts commonly remains unaffected. But under certain comparatively rare circumstances, the boundaries of the morbid sound may be more or less completely altered by causing the patient to vary his posture; the infra-scapular region, which may have been toneless almost when he lay on his side, or reclined backwards, will give a well-toned normal sound, after he has remained leaning forward for a short while, and *vice versa*. This moveableness of the sign indicates moveableness of its cause; and fluid collection in the pleura, from pleurisy, hydro-thorax, and perhaps hæmo-thorax, is the only physical state of which the percussion-signs have, hitherto, been admitted to be thus characterised: the fluid will, of course, gravitate to whatever part of the patient's chest his changes of position render the most dependent. It is, however, by no means so constant a sign of pleuritic affection as might, from *a priori* considerations, be expected. The liquid is retained *in situ* in some cases by adhesions, which easily explains the fixedness of the

deficient resonance; in other instances, the explanation cannot be found.

224. I some time since met with a case in which a massy encephaloid tumour hung by a sort of penduncle of condensed lung-substance to the surface of the organ, and so loosely that it must have altered its position as the patient turned from side to side.* But there was enormous pleuritic effusion present on the patient's admission, which would of course have prevented the discovery of any change of place of the tumor, had the idea of looking for such locomotion occurred to me: the source of fallacy must be infinitely rare. More recently I ascertained, in a case originally seen by Dr. Evans of Birmingham, that even in cases of solid infiltration of a lung, decumbency on the sound side may displace the morbid resonance of the diseased one,—carrying it to the opposite side of the median line at mid-sternum.

225. In hydro-pneumo-thorax the air and fluid may sometimes be made to change relative positions, to a certain extent by changing the patient's posture; the site of the exaggerated resonance will, unless adhesions interfere, always be towards the upper surface.

B.—DYNAMIC SIGNS.

226. It has been seen, that in health the act of respiration modifies the results of percussion in three different ways; now in disease the natural modifications may be perverted or impeded, and hence a certain number of dynamic signs. Few of these signs are of practical importance; but occasionally some of them prove valuable.

227. As regards the *increased volume of the lung*, and the consequent extension of pulmonary resonance, attending inspiration in health,—neither will occur in cases of hydro-thorax, pleuritic effusion, and pneumo-thorax, of emphysema, and obstruction of the chief bronchus, either from foreign bodies or plastic secretion within it, or from pressure, aneurismal, glandular, or other, without it. In a remarkable case of the latter kind, where the respiration was permanently weak, the failure of inspiration in increasing or extending the resonance of the side, contributed much to the diagnosis of obstruction of the main bronchus.† Further, in cases where, during expiration, air, which in health would escape, still stagnates within the chest, the

* Dewing, U. C. H., *Males*, vol. v. p. 19. U. C. Museum, No. 4000.

† Mary Ransom; U. C. H., Nov., 1848.

residual and supplementary volumes [122] are constantly on the increase, and there will not be a sufficient reduction, during expiration, of the area over which pulmonary resonance is discoverable.

228. *Mutatis mutandis*, the *respiratory influence on the percussion-note* may be similarly affected. In health, full inspiration increases the loudness and lowers the pitch of the sound of percussion, and equally so on both sides of the chest. Now certain states of disease, impeding full pulmonary expansion on either side, interfere on that side with the production of the changes discoverable on the other after full inspiration; hence a sign founded on *comparatively deficient increase of loudness and fall of pitch at the close of a full inspiration* on either side, the sound being equal on both in the ordinary state of respiration.

Per contra, the sound of the healthy chest is somewhat deadened and its pitch raised by full expiration, and equally so on both sides of the chest. Now certain states of the lung destroy this equality by rendering the sound disproportionately toneless in the situation where they exist: hence the sign of *comparatively great diminution of tone with too high pitch at the close of full expiration*.

Both these delicate signs sometimes give very satisfactory results in cases of small, irregularly scattered indurations, tuberculous or other, of either apex. The mechanism of the former is obvious; the latter depends on reduction of size of the lung, in expiration, bringing within a small space solid matter which had previously been more widely scattered.

229. Or, on the other hand, other states of the lung, by impeding the expulsion of air, render the sound disproportionately pulmonary; hence the sign of *comparatively deficient diminution of tone with too low pitch at the close of full expiration*, a sign discoverable in emphysema and obstructed bronchus. If there be air in the pleura, the same result will occur.

230. The diseased conditions in which respiration ceases to exercise any influence on the position of the heart and abdominal viscera may be inferred from the foregoing exposition.

II.—ALTERATIONS OF RESISTANCE.

231. In his introductory observations upon physical diagnosis in general, Laennec makes a passing allusion to the "sense of elasticity perceived" in percussing; but in no instance refers to the diagnostic indications derivable from changes in this elasticity. Piorry and others have availed themselves of them fully, but their

importance is not generally appreciated. There are cases of not very rare occurrence, in which erroneous inferences would almost inevitably be drawn from the sound elicited by percussion, were these not corrected by the information derived from the degree of resistance felt by the fingers. Take the case of a cavity seated close to the surface: the unnatural amount of sound which sometimes distinctly exists over such cavities, quite independently of tubular or amphoric quality, might not only lead to an incorrect estimate of the state of the subjacent part, but also to the inference that the lung, in reality, least affected, was the most diseased. The sensation of hardness and firm resistance experienced by the fingers suggests the true cause of the unusual resonance. Besides, the cases are extremely numerous in which it is satisfactory to have the corroborative evidence, furnished by the state of resistance, in favour of the inference drawn from the sound. That doubt often exists as to the relative resonance on the two sides, is unquestionable; and in these cases the condition of the subjacent parts may frequently be settled by taking into consideration the amount of resistance. To those persons whose sense of touch is more delicate than that of hearing, this source of diagnosis is of especial value.

232. In the descriptions of changes of sound, a good deal has been incidentally said on those of resistance; but recapitulation is advisable. The resistance depends on the state of the contents, and of the walls, of the chest. All conditions lessening the relative quantity of air in the lung, while they deaden the sound, increase the resistance; they have already been enumerated. All conditions which conversely increase the relative quantity of air, decrease that resistance, while they increase the volume of resonance: these also have been enumerated: pneumo-thorax is the typical disease. But the walls of the chest may be so stretched in that very affection by growing accumulation of air, that the resistance becomes considerable, though the sound continues abundant and toned: nay, eventually, the air-distension, carried to the possible limit, may entail extreme parietal resistance and quasi-nullity of tone. Here the state of the walls themselves modifies the resistance; as it does likewise where solid or liquid matters accumulate in their substance, where the periosteum thickens, or the ribs either enlarge, or, as in the retraction-period of chronic pleurisy, become unduly approximated to each other.

SECTION V.—AUSCULTATION.

233. **Auscultation** means the act of listening, and is termed pulmonary or cardiac, according as the sounds listened to are produced in the lungs or in the heart.

234. The direct object of pulmonary auscultation is the appreciation of certain sounds audible on the external surface of the chest, and either produced by the respiratory play of the lungs themselves, or transmitted in a modified form by these organs from others, as for example the heart, in which they are actually evolved.

235. The method of performing auscultation may be *immediate* or *mediate*. In the first case the ear is applied directly to the chest; in the second, an instrument of variable material and construction (originally a hollow cylinder of wood, to which the name of stethoscope* was given by Laennec,—a name retained for its various modifications), is used as a conducting medium between the surface examined and the ear.

236. Both of these methods of auscultation have had their favourers and their detractors. The advocates of mediate auscultation urge that—The stethoscope can be closely applied to several points of the chest, as the axillary, upper scapular, supra-clavicular regions, and acromial angle, where the ear cannot be placed in accurate contact with the surface;†—the use of the stethoscope enables the observer to auscult in a posture more easy to himself, than that he is obliged to assume if he apply the ear directly;—it is indelicate to place the head upon the persons of females;—it is disagreeable to bring the head in contact with the bodies and clothes of some of the lower orders;—the limits within which the various sounds are perceived are more nicely circumscribed with the stethoscope than with the unassisted ear;—certain phenomena, as pectoriloquy, are more distinct when the stethoscope is employed. On the other hand, while the partisans of immediate auscultation admit that in lean persons it is difficult to place the ear appropriately in some few situations, they affirm that such cases very rarely occur, and that in all others the stethoscope is an *inutile lignum*,—the direct application of the ear giving as precise indications as the employment of that instrument, with less appearance of fuss, and less real trouble. For my

* From *stēthos* "the chest," and *skopos* "to examine."

† These points are still more numerous in malformed chests.

own part, I entertain no doubt that Laennec and others have greatly exaggerated the superiority of mediate over immediate *pulmonary* auscultation in respect of the distinctness with which the phenomena are heard, and the precision with which they are circumscribed, in cases where both modes of auscultation can be employed; and that this distinctness and this precision are in fact greater in such cases with mediate or with immediate auscultation, according as the observer is more habituated to one or other of these modes of examination. It seems very plain, however, that as there are cases in which the ear cannot be directly applied, or in which it is disagreeable or indelicate to do so, mediate auscultation is the method with which the student should most closely familiarise himself; while, on the other hand, as it is often difficult to persuade children to allow the stethoscope to be applied, and as we may often desire to auscult an adult when no instrument is within reach, the ear should be practised in immediate auscultation also.*

237. The proper construction of the stethoscope has been a subject of constant dispute. As was felt by Laennec, theory, in the present state of acoustics, deposes in favour of the solid instrument; yet, as a hollow one is almost universally employed, it may be inferred that theory is somewhere at fault. From trials with hollow and solid ebony and cedar stethoscopes, I have come to the following conclusions:—That with the hollow instrument the respiratory sounds appear stronger, lower pitched, and more open in quality,—with the solid, weaker and sharper, so much so that a bronchial character may be simulated; that cavernous phenomena lose in some measure their hollow quality with the solid instrument; that friction-sounds are sometimes materially better heard with this; that the natural vocal resonance over the trachea is hollower, graver, and better articulated with

* Heretofore all thought, first-rate skill in *pulmonary* auscultation might be acquired without using the stethoscope at all, though it is common to hear the *omission* of the instrument considered as constituting *laennecisme* a *faute de mortalité*. No, has none who is responsible, because he *describes* *auscultation* for the clinics of Hippocrates, Huc and Double, ever without justice being rendered, described accurately the most delicate, and traced them *conformément* to their physical conditions. Persons, indeed, exist, but few, who seem to think that the stethoscope possesses some mystic power of *clairvoyance* in detecting *laennecisme*, and among the sanctor all trundle of thought; unfortunately, the instrument is no more than

... das tolle Sprachrohr, das den Schall
 heraufholt und wiedergibt, und nicht mehr besitzt.

The master of the stethoscope might aptly run

... *magister vice totius domini*
 Reddere quæ terram valet, excoque ipsa sonant.

the hollow cylinder; and that the resonance of the observer's own voice, as he speaks, while auscultating the chest of another person (autophonia 466*), is materially more intense with the solid than the hollow instrument.

238. Glass, gutta-percha, and metal have been tried, but are certainly inferior, for various reasons, to wood,—deal and cedar on the one hand or ebony on the other. Ivory (as I once had an opportunity of observing with an instrument lent by Mr. Cheverton) notably intensifies the sound. But the really important point is, that the ear-piece should fit the ear well,—it is as necessary to try on a new stethoscope, as to try on a new hat. Beyond this, all depends on the use to which the student puts the instrument, and not on the density or quality of the material or the direction of its fibres.

239. A double flexible stethoscope, formerly patented by Dr. Cammann of New York, so intensifies the sound, according to Dr. Flint, as to render auscultation available to persons with impaired hearing. But as confessedly the instrument alters the pitch and the quality of the sounds—makes them that to his ear which they are not—is it not likely the deaf observer would be rather deceived than enlightened by the information acquired?

240. Dr. Alison recommends the interposition of an india-rubber bag of water (hydrophone), as a useful adjunct to the stethoscope, under a variety of circumstances.*

241. In performing auscultation, several precautions, affecting the observer and the observed, are to be attended to. 1. The chest should be uncovered; or if, from circumstances, such exposure be inadmissible, as thin a layer of clothes as possible allowed to remain between its surface and the stethoscope. 2. All friction between the stethoscope and the patient's or the observer's clothes should be carefully prevented. 3. The position of the patient should be regulated in the same manner as for the performance of inspection; an unconstrained state of the muscles being particularly necessary, in order to insure free entry of air into the lungs. The sitting posture is, everything considered, the most conducive to perfect investigation, provided the chair employed have a tolerably high seat, and the observer be of the middle height; a tall person will find himself most at his ease, if the patient stands. It of course frequently happens that the recumbent posture is the only one the patient can easily assume,—he may be perfectly unable even to turn on either side. Under these cir-

* Medical Times, July, 1859.

circumstances the utility of the flexible stethoscope has been insisted on, as it may be applied far back laterally, and even to the dorsal regions, if the body be inclined a little sideways, without moving the patient. I confess I have never yet seen an ordinary case of pulmonary disease, whether primary or secondary, in which, so long as it was a matter of importance to auscult the chest, the patient might not be raised sufficiently by careful attendants, to admit of the examination being efficiently made, for practical purposes, with the common stethoscope or ear alone. Still attendants may not be within reach; and, in special cases, tendency to syncope may make it dangerous to raise the patient's head; here the flexible instrument will be useful. Besides, it saves the observer the necessity of stooping,—which may to some persons be a matter of importance. If in the sitting posture, while the front of the chest is submitted to examination, the patient should sit not exactly erect, but with the trunk sloping a little backwards, the arms being allowed to hang loosely at the sides. When the observer proceeds to examine the lateral regions, the patient may be directed to clasp his hands on the top of the head,—in other respects, retaining his former posture; and, lastly, when the dorsal regions are examined, sit upon the chair sideways, or if a male, a-straddle, with his back to the observer, his arms crossed, and his head bent somewhat forwards. *Mutatis mutandis*, the same precautions are to be taken when the patient stands, lies, or sits up in bed. 4. It is of importance to apply the stethoscope firmly, but not forcibly, to the surface: too slight or too strong pressure interferes with the accurate transmission, or alters the character, of the sounds. 5. Great care must be taken to insure accuracy of contact between the skin and every point of the circumference of the end of the stethoscope; as a necessary condition for this, the instrument must be applied perpendicularly to the surface, and held until firmly placed, by its applied end: the auscultator may then readily assure himself with the fingers, whether the skin and the edge of the instrument are in accurate apposition. 6. The posture of the observer should be free from all constraint; he should apply his ear to the stethoscope with as much care, as the instrument to the chest; concentrate his attention upon the sound examined; and, unless he be thoroughly experienced, proceed, as far as is compatible with the patient's safety, slowly with his examination. The motto *festina lente* is a good one for the beginner in the study of physical diagnosis. 7. It is advisable to commence the auscultation of patients, while

they breathe in the manner to which they are naturally inclined: because it is important to ascertain the precise condition of the *tidal* respiration, and because directions for the regulation of the act often puzzle. Some individuals, however, absolutely require guidance: as the moment they perceive the instrument applied to their chest, they throw the muscles of the trunk into violent and unnatural motions, which materially impede the entry of air into the lungs. The simplest way of making such persons breathe in an efficient manner is, to perform several quick noiseless respirations before them, and desire them to imitate these. This method will, however, occasionally fail; our object may then be gained by desiring them to sigh, to speak, or to cough. The deep inspiration required for the performance of these acts will at once enable the observer to ascertain the condition of the sounds; and, indeed, there are many states of the lung in which, quite irrespectively of the patient's manner of breathing, much information may be gained by a single cough. It is to be remembered, however, that by these artifices we lose the simple tidal respiration. 8. The sounds produced in the pharynx by the passage of the air are liable to be confounded with the true pulmonary sounds of respiration; the error may be avoided by directing the patient to open the mouth, if it have been previously shut, and *vice versa*. If the sounds heard have their seat in the lungs, they will suffer no notable change from this opening or closing of the mouth; if in the pharynx, they will be more or less modified in character. It is, however, only in unusual cases that a direction of this kind is necessary to enable a practised auscultator to avoid the error referred to; though it may often be advisable to corroborate thus the impression derived from ordinary examination. The sensation of distant production which attends the pharyngeal sounds, and the occurrence of a distinct interval of time between inspiration and expiration (a point to which I particularly recommend attention), will suffice to distinguish them from the true pulmonary sounds. With ordinary watchfulness, the observer may distinguish the two kinds of sound at the same time. 9. Both sides of the chest must be submitted to precisely the same examination,—conducted precisely in the same way,—as already explained in reference to percussion. 10. Auscultation should never be considered complete, until the entire chest has been examined: it is often in some or other situation, where symptoms would least have taught us to look for disease, that auscultation proves its existence. 11. In acute affections, auscultation should be repeated

twice, at least, in twenty-four hours. 12. The student should accustom himself to the use of both ears.

§ I.—THE SOUNDS OF RESPIRATION.

I.—IN HEALTH.

242. Two sounds, discoverable by auscultation of the breathing apparatus in the state of health, attend each act of normal respiration: one, corresponding to the movement of inspiration, the other, to that of expiration. These are the *inspiratory* and *expiratory sounds*.

243. The *essential or primary properties* of these sounds, practically considered,—those which, in their modified states especially, possess diagnostic importance,—are: *Special Character and Quality; Pitch; Intensity; Duration; Liquidness; Softness; and Rhythm*.

244. By the *special character* of a sound is understood that peculiarity, which must, under all conditions of intensity, duration, rhythm, pitch and key, distinguish it from others; the special character of the sounds of a piano-forte, for example, will invariably differ from that of the tones of a violin. Here also, for the purpose of simplifying the subject as far as possible, without incurring any material sacrifice of accuracy, may be included that property of sound known as *quality*; though, in point of fact, the *quality* or “timbre” of a sound is a different thing, acoustically speaking, from its *character*. Thus, two voices, identical in point of character and of register—say, tenor—will sound the *same note*, in the *same rhythm*, with the same amount of *liquidness*, with the same *intensity*, and for the same *duration* of time, and yet a marked difference shall exist in the sensations impressed upon the ear by the two tones: that difference depends on the *quality* of each; and by it any two tenor or soprano voices are as easily distinguishable from each other, as any one of the four from those of bass or contralto register. Variety in quality is supposed to depend on varying form of the sonorous waves; but the conditions determining that form have not been ascertained. As the quality of the notes of musical instruments varies with the precise form and properties of the material composing them (the secret of the Cremona violins lay in their form and component woods), it may reasonably be conjectured that the form of the vocal tube and the tension, dryness, elasticity, and other properties of the tissues

engaged in the production of laryngeal and pulmonary sounds modify the quality of these.*

The *pitch* of sounds rises as the frequency of the vibrations in a given time of the sonorous body; the evident variations in pitch of the respiratory sounds under different circumstances immediately depend on variations in that frequency,—but why, or through what mechanism, the frequency is affected by different anatomical conditions, is unknown.

245. The terms *intensity* and *duration* explain themselves. The notions of *dryness* and *liquidness* of sound may be at once obtained by squeezing close to the ear first a perfectly dry, and then a moistened sponge. Similarly if we press together a mass of wool held beside the ear, the property of *softness* in sound will at once become intelligible; its converse *hardness*, by grating together any two hard bodies. The *rhythm* of a sound means its mode of progression or evolution, which may be continuous and equable, or interrupted and jerking.

246. Although in originally establishing the varieties of morbid breathing, every respiration-sound requires to be analysed in respect of these various properties, the complexity of the matter is much less in actual practice than it seems; for experience proves that several of these properties are almost invariably altered simultaneously, and of course such compound states may be described for convenience' sake by single phrases.

247. The properties of the sounds differ in the various divisions of the respiratory organs; for each of these divisions there is a healthy type of respiration, termed, *pulmonary*; *bronchial*; *tracheal*; *laryngeal*; *pharyngeal*; according to the part of the respiratory passages from which the sounds audible externally are transmitted.

248. The sole point in which these various types of respiration agree is, that in all of them the audible sound may be resolved into two—an inspiratory and an expiratory. From their numerous distinctions they require separate consideration.

* Some of the conditions regulating the *quality* of the human voice are theoretically under the influence of the will: and, as matter of experience, it seems certain that imitative effort will succeed in modifying the *quality* of vocalised tones. Thus I knew a tenor singer who managed, especially during the opera season, to throw every now and then into a chance musical phrase though his organ had no pretensions beyond those of an almost every-day drawing-room tenor: a something that faintly recalled the marvellous *tint* of the voice of the tenor of tenors, Mario,—of that voice which in sympathetic melodiousness, as in truth in all other forms of perfection, has never been approached. This person assured me his modulating faculty, which almost completely disappeared with the annual disappearance of the model, came of imitative effort.

249. *Pulmonary*.—The pulmonary *inspiratory* sound is of gentle breezy character; neither liquid nor dry; soft; of a certain intensity and duration; and in respect of rhythm, gradually developed and continuous. The *expiratory* sound, slightly harsher and hollower than its predecessor, and of lower pitch, is about three or four times the weaker and shorter of the two, and in about one of every four healthy persons, especially at the left side of the chest, proves actually inaudible.*

250. The term "breezy" seems the fittest by which to describe the character of the healthy respiratory sounds. They suggest in their pure state the sighing murmur of the breeze among leaves, the only difference being one of intensity. The use of the term *vesicular*, in speaking of the natural condition of these sounds, has led to an erroneous impression. It was originally applied to designate the supposed seat of their production; but not a few persons have incorrectly referred the term to their special character. There is nothing in the nature of the respiratory sounds suggestive of a connection with vesicles; and, whenever such character occurs, the phenomenon it attends is morbid.

251. The two sounds so closely follow each other in each healthy respiration, that they may, practically speaking, be said to be continuous. This continuousness, indeed, forms an important character of *pulmonary* respiration of *healthy* type. It would of itself be sufficient to announce the lung as the part ausculted; for it will be found that in proportion as auscultation is practised, in health, at a further point from the pulmonary parenchyma, so will the two sounds be more and more distinctly separated from each other by an appreciable interval of time,—an interval which consequently attains its maximum opposite the larynx and upper part of the throat.

* The fact that the escape of air from the lungs during expiration is commonly attended with audible sound was known to, and is distinctly stated by, *Laennec*. But the importance of the expiratory sound, the valuable indications its modifications afford in the diagnosis of disease, did not sufficiently attract his attention, and to the late Dr. Jackson, jun., of Boston, U. S., belongs the credit of conserving the value and extent of information which might be obtained from its analysis. In a most careful paper, read in 1832, before the Medical Society of Observation of Paris, that zealous inquirer forcibly drew attention to the subject. M. Louis and several of his pupils submitted the remarks of Jackson to the test of observation; his announcements were found generally correct, and thenceforth the separate consideration of the expiratory sound became with them habitual. Dr. Cowan subsequently furnished the English public with a valuable paper on the subject ("London Med. Gaz." vol. xviii. p. 382). M. Fournet at a later period investigated it more thoroughly than his predecessors, and popularised what had previously been known only to the comparatively few, but he seems to have fallen into repeated excesses of strained refinement.

252. What is the site of production of the pulmonary sounds? — and what is the mechanism by which they are generated? M. Beau* long since endeavoured to show that the respiratory sounds, heard on the surface of the chest, are not produced in the lungs; but are simply the pharyngeal sounds attending the entrance and exit of air through the pharynx, transmitted through those organs. Two facts seem to disprove this theory; — the existence of an appreciable pause between the respiration-sounds opposite the pharynx, while there is none such over the pulmonary structure; and the occasional possibility of hearing at one and the same spot of the chest-surface, both ordinary respiratory, and pharyngeal, sounds. Besides, the two pharyngeal sounds are quasi-equal in length, the pulmonary extremely unequal; and destruction of portions of the fauces does not alter or impair the pulmonary sounds. The three first of these objections are equally fatal to Dr. Spittal's theory,† that in the glottis is the main origin of the sounds. A fourth is to be found in the fact that there is no direct ratio between the intensity of sound heard over the larynx and that audible over the chest: the loud pulmonary inspiration-sound with which air makes its way into the lungs, through an artificial opening in the trachea, is well known,‡ while, *per contra*, laryngeal and tracheal stridulous respiration is commonly attended with very weak pulmonary sound.

253. Laennec believed that the sounds were engendered by "the entrance of the air into, and its expulsion from, the air-cells of the lungs;" and this, with a qualification to be presently considered, appears to be their essential cause. The terminal portions of the bronchi are also probably concerned in the sounds,—the vibrations of the moving air, and moving parenchyma, and the distension of the air-cells, all, doubtless, contributing to the general result. The excess of inspiratory over expiratory sound is very difficult of satisfactory explanation,—especially when it is borne in mind that the inspiratory is a feebler act than the expiratory [133]. I can only suggest as a tentative solution of the problem that the excess in loudness and duration of inspiration-sound over expiration-sound depends upon the current being in the former instance directed towards, in the latter from, the ear of the observer. If a sponge, slightly moistened, be placed between

* Arch. Gén. de Médecine, 1834.

† Edin. Med. and Surg. Journal, vol. xli.

‡ *Coley, op. cit.* 4. U. C. H., *Trans. S.*, vol. ix. p. 167. I have observed the same fact in four or five other cases of tracheotomy.

two stethoscopes, and one person breathe naturally into one of these, while a second auscults by the other, it will be found that the difference in force of the sonorous currents towards and from the ear of the auscultator is about the same as between the intensities of natural inspiration and expiration. And, again, if a sponge in the same state be held close to the ear, and alternately pressed and allowed to expand, it will be found that the closure of the cells of the sponge is almost noiseless, their expansion accompanied with well-marked sound: the ratio is very much that of the expiratory and inspiratory sounds.

But Laennec was incorrect, I feel persuaded, in supposing that the actual air of each inspiration is directly concerned in generating the corresponding sound. The tidal air, in truth, does not reach the cells. In calm breathing the stagnant air [122] is never expelled from these: in forced breathing the supplementary share of the stagnant volume is displaced; but the residual and persistent quotas remain. Clearly, then, it is not the tidal air itself that, impinging against the cell-walls, evolves the sound, but rather the supplementary and residual volumes which, in their retreat before the influx of tidal air, recover the position they had partially evacuated in expiration.

A well-devised attempt, made by Dr. Hyde Salter,* to elucidate the question under consideration, led him to the following conclusions: "1. That the air-cells are structurally incapable of producing a respiratory murmur by their slight dilatation. 2. That the respiratory murmur is, immediately and essentially, a fine tube sound. 3. That the lobular passages and ultimate bronchial radicles are probably its immediate seat. 4. That while the lung parenchyma, from its heterogeneous constitution, completely muffles all deep-seated sound, the unbroken column of air in the bronchial tree is an excellent conductor: that thus the respiratory murmur has a double cause, and is in part the result of air-and-wall friction at the spot, and in part the bronchial sound of the larger tubes (although essentially modified) conducted by the unbroken column of air to the ultimate bronchial twigs. 5. That the restriction of the sound to inspiration depends mainly on convection, but probably also in part on the great amount of air-and-wall friction produced on the impact of the air at the points where the tubes divaricate." Dr. Salter adds: "In Dr. B. Sanderson's opinion, the respiratory sounds must be generated where air-and-tube-

* *Med. Chir. Rev.* 1864.

wall friction is greatest,—that this must be at the point where the non-expandible portion of the lung-structure joins the expandible—in other words, where the air-tubes end in the air cells."

In my mind, Drs. Salter and Sanderson very satisfactorily refute each other; and it will probably be admitted by any impartial person that in the present state of thoracic physics no single view hitherto tendered is capable of being demonstrated. Fortunately this unsettled state of the physiological question throws no cognizable difficulty in the way of *practically* interpreting the significance of aberrations from the types of health.

254. The conditions of the pulmonary sounds may vary within certain limits from those just described, without the type of respiration ceasing to be compatible with health of the lungs. In other words, there are *healthy varieties* of respiration. They are referrible to the following circumstances: *age; sex; the part of the chest furnishing the sounds; the rapidity and fulness of respiration; temperament; and idiosyncrasy.*

255. *Age.*—The description given of healthy respiration refers to that of adults; at either extreme of life its characters are different. In infancy the *intensity* of sound is considerably greater than at a more advanced age, all the other properties of both sounds remaining unaltered both positively and relatively (*puerile* respiration); the expiration-sound appears disproportionately long only from its greater intensity. The smallness of the vesicles at this age, and hence the more extensive surface, concerned in the production of the sounds, seems to account best for their excess in infancy. The slightly greater frequency of respiration in childhood seems inadequate to its explanation, especially as there is no such difference in the laryngeal respiration-sounds of childhood and adult age. In old age, on the other hand, the *intensity* of the sounds is sometimes diminished, and the duration of inspiration lessened, while that of expiration is increased (*senile* respiration). Healthy senile respiration, as it may be called, differs from morbidly *weak* respiration in the increased duration of expiration. Andral has referred to its characters, and justly connects it with the rarefied and inelastic state of the lung which arises, as a condition of natural decay, in advanced life.

256. *Sex.*—The pulmonary respiration-sounds are generally louder in the female than the male; and certain peculiarities, to be presently mentioned, are of more frequent occurrence in the former than the latter sex.

257. *Region and Side of the Chest.*—The sounds are fuller

superiorly than inferiorly, especially in women, and in front than behind. They are audible even at the lower edge of the right and left infra-mammary regions on full breathing; if the liver be enlarged, they may even be heard, within the confines of the abdomen, over that organ. Similarly over enlarged kidneys and abdominal tumours they can occasionally be caught posteriorly, at a short, not precisely limitable, distance below the area of the chest.

258. The conditions of respiration vary of necessity at certain corresponding parts of the two sides in consequence of difference in the subjacent structures; obviously the breath-sound must be dissimilar over the mid-heart region and the fellow spot on the right side. But where the constitution of the texture beneath is nearly or perfectly identical, is there an absolute identity in the sounds? I have devoted much time to the examination of this question at the apices of the chest (where for obvious reasons it possesses most importance)—and the results obtained oblige me to somewhat modify certain opinions expressed in the earlier editions of this work. It is quite true, there is no excess, as a constant condition, in the length and intensity of the respiration-sounds in either upper region of the chest,—nor do the pitch and quality of necessity differ. But appreciable differences in these points are of sufficient frequency in perfectly healthy chests to impress upon us the wisdom of caution in ascribing to incipient disease very slight inequalities in the two sides, even where pulmonary or dubious general symptoms may entitle us to look for something physically wrong in the lungs. The infra-clavicular regions may be tabularly compared as follows:—

	INSPIRATION.		EXPIRATION.	
	Right.	Left.	Right.	Left.
Intensity . . .	—	+	+	—
Length . . .	—	+	+	—
Pitch . . .	Higher	Lower	Higher	Lower
Quality . . .	Harsher	Softer		

From a glance at this table it becomes apparent that a greater tendency exists to bronchial character in the respiration at the right front apex than at the left, while excess of loudness and duration of inspiration may pretty frequently be looked for at the

left. The same differences very closely obtain at the supra-spinous fossæ. The student will remember that the statements in the table profess only to show what kinds of difference are *most common*, where difference exists at all; I cannot pretend to supply a numerical estimate of the relative frequency of each.*

259. *Rapidity and Fullness of Respiration.*—The *intensity* of the respiratory sounds increases directly as the rapidity of breathing; their duration, as its fullness. When the respiration is at once full and rapid, both those properties are affected simultaneously; but neither *character* nor *pitch* suffer change.

260. *Temperament.*—The respiration-sounds are, generally speaking, of greater intensity in persons of nervous temperament, and in those labouring under certain nervous affections, as hysteria, than in people otherwise constituted.

261. *Idiosyncrasy.*—In some individuals the respiratory sounds are unusually weak or unusually strong,—and the peculiarity, not being traceable to any particular cause, is spoken of as an idiosyncrasy.

262. The proportional duration and intensity of the expiratory sound vary much in different chests; in not a few persons, as we have already seen [249], expiration is non-sonorous,—noiseless in fact. This absence of expiratory sound is, according to my experience, most frequent in males; and when it exists, is a natural peculiarity, and in no instance the effect of disease. The exception which may be taken to this latter statement, in some cases of emphysema, is only an apparent one.

263. *Bronchial respiration*, audible between the scapulæ, at the upper end of the sternum, and the sterno-clavicular angles, in the sites corresponding to the bifurcation of the trachea, wants in both its divisions the perfect softness and gentle breeziness belonging to the pulmonary species; both are slightly harsher, of higher pitch, more rapidly evolved, especially the expiratory, and follow each other less closely, are less accurately continuous, than in pulmonary respiration. In some persons the respiration is very purely pulmonary, even between the scapulæ.

264. *Tracheal, laryngeal, pharyngeal respiration.*—The respiratory sounds, as heard over the trachea, larynx, and pharynx, are

* Dr. Flint, in a most careful examination of healthy apices, found an interval between inspiration and expiration-sound in "several cases" under the right clavicle. This would be an additional approach to bronchial breathing, but for my own part I have failed to find it in positively healthy infra-clavicular regions, except at the sterno-clavicular angle, where the respiration is confessedly, as a natural state, more or less bronchial.

considerably more intense, less soft, drier, hollower in quality, more whiffling, of higher pitch, and more rapidly evolved, though of greater duration, than in the divisions hitherto considered. While in pulmonary respiration the two sounds differ very materially in duration and intensity, in these upper sections of the system they tend to equalisation in these respects, —the second perhaps slightly exceeding the first; and instead of being almost continuous, are separated by an interval of some duration. The expiratory is also sharper than the inspiratory sound.

II.—IN DISEASE.

265. The phenomena discoverable by auscultation of the lungs in disease are:—Modified breathing-sounds; and Adventitious sounds produced by the act of respiration.

A.—*Modified Respiration-Sounds.*

266. It is extremely rare to find one only of the primary properties of the respiratory sounds affected; in by far the greater number of cases two or more of them suffer alteration at the same time; and thus are produced compound conditions of change, which may be described as distinct species of morbid respiration, and classified as follows:—

Species of unhealthy respiration distinguished by changes of

(a) *Duration and Intensity*: Exaggerated, weak, and suppressed respiration:

(b) *Rhythm* (either solely or in conjunction with other properties): Jerking, and divided respiration; deferred inspiration; unfinished inspiration; altered ratio of inspiration to expiration:

(c) *Quality*, and in addition other properties, especially *pitch and rhythm*: Harsh and bronchial respiration and blowing respiration, with its main varieties, simple and hollow.

267. (a) *Alteration of intensity and duration.*—*Exaggerated respiration* is essentially distinguished by an increase in the intensity and duration of both sounds, especially the expiratory,—an increase unattended with modification of any kind, either in respect of special character, softness, or liquidness. It is, likewise, termed *supplementary*, because the pulmonary tissue, in which it is produced, often supplies by increased energy the loss sustained by the inactivity of some other part; and *puerile*, on account of

its similarity to the natural respiration of children. However, there is this difference between the supplementary respiration of the adult and the natural respiration of infancy, that the expiratory portion of the former is proportionally more affected. Undue prolongation of the expiratory sound depending directly on disease, may be distinguished from that of exaggerated respiration, by its being attended with modifications affecting *quality*, *softness*, and *liquidity*.

268. The causes of exaggerated respiration are unnaturally rapid influx and efflux of tidal air through the lung, together with an increase in the quantity and the force of impulsion of the retreating residual air [253] against the walls of the vesicles, and probably, in the *number of these expanded by each inspiration* in the spot:—all this being the result, except in very rare cases, of the inaction of some part of the same or of the other lung. Of very variable seat and extent, it occurs: (1). In healthy tissue, adjoining parts *obstructed* by bronchitis, new productions of foreign bodies in the bronchi; *condensed* by plastic effusion, by pneumonia, by tuberculous, cancerous, or simple consolidation, by apoplectic effusion, &c.; or, *rarefied* by vesicular emphysema: (2). In healthy tissue, suddenly *released from bronchial spasm*, as in spasmodic asthma: (3). In tissue itself affected with *hypertrophy*? Exaggerated respiration, then, though not a direct result or sign of disease, except in the last rather doubtful case, furnishes valuable indirect evidence of its existence, and bears the same relation to the morbid condition entailing the excess of breathing, as, to use the happy expression of Fournet, the shadow to the substance.

Exaggerated respiration at an apex, in which tuberculization is commencing, is a source of error against which the student must be on his guard.

269. *Weak respiration* is characterised by a simple diminution in the *intensity* and *duration* of the respiratory sounds, without change of their other properties. When the quality of the respiration is simultaneously altered, the breathing belongs to another type. There are two varieties of weak respiration; the *superficial* and the *deep-seated*. In the former the weak sounds appear to be produced at the surface of the lung or immediately under the walls of the chest; in the latter, at a greater or less distance from these walls. The physical conditions present explain these peculiarities; in the latter, the portion of lung in which the weakness exists is in reality removed to a certain distance from the walls of

the chest by the intervention of adventitious fluid or solid matter ; in the former, no such removal of lung occurs.*

270. Weak respiration depends on deficient flux and reflux of air in the affected part, itself commonly caused by mechanical obstruction. It is of variable seat,—may be limited to a spot in one lung, or pervade the entire of both lungs.

271. The *superficial* variety occurs, in a *persistent* form, in obstructive diseases of the larynx and some of the pharynx; narrowing or obliteration of a bronchus by contraction, thickening of mucous membrane, accumulated mucus, or pressure of tumours, cancerous or other; bronchitis; chronic consolidation of the lung, or infiltration with tubercle or other morbid product in a limited space; vesicular emphysema; pneumonia, previous to engorgement and after resolution; pulmonary cedema; pulmonary apoplexy, and imperfect respiratory movements from paralysis. In an *intermittent* form, it occurs in pleurodynia, in the dry and plastic stages of pleurisy, spasm of the glottis, spasmodic asthma, and where foreign bodies block up the air-passages. This intermittence constitutes an important feature in the physical signs of a foreign body in either bronchus, depending manifestly upon its gliding from place to place, and consequent greater or less interference from time to time with the entry of the air. In some cases of pneumonia the same intermittent character of respiration may be observed; it indicates intermittent pressure on the main bronchus of the affected side.†

272. The *deep-seated* variety occurs in the effusion-period of pleurisy, in hydro-thorax of moderate amount, and in pneumothorax.

273. In Cholera Asiatica the weakness of respiration seems partly dynamic, and partly of hæmic, or blood, origin.

274. *Suppressed Respiration* consists in a total absence of the respiratory sounds, without their being replaced by any kind of audible phenomenon. There is a complete negation of breathing-sound in the part; but, it is urged by M. Fournet, there is still heard in some cases, towards the close of the movement of inspiration, a slight noise, “which appears to result from the lateral pressure, exercised on the pulmonary tissue, of the column

* It is said by Skoda the distinction of superficial and deep seated sounds within the chest is impossible. The point is only to be determined by experience; but why, even *præter ræse*, the idea of variable distance should not belong to sounds produced in different parts of the chest, as well as to sounds in general, does not appear very plain.

† Beckett, U. C. H., *Males*, vol. v. p. 231.

of air which fails in entering the bronchial ramifications." For this noise he proposes the name of "sound of pulmonary compression." I have not, in such cases, been conscious of the occurrence of a distinct sound; but an indefinable sensation of struggle within the chest against obstruction may often be perceived.

275. The causes which produce weakness of respiration entail, when carried to extremes, its total suppression. It is probable that the respiratory sounds are actually more or less extensively suppressed in almost all cases of infiltrations of the lung, tuberculous or other; but it is, for obvious reasons, in rare instances only that the suppression can be detected,—adjoining exaggerated respiration masks the local deficiency. In some cases of pneumonia, especially of the caseous form, independently of accidental obstruction of a main bronchus, there may be no audible respiration,—I have seen several of the kind. But, clinically, the common causes of such suppression are fluid and aeriform effusions in the pleura, and complete obstruction of a bronchus; in some rare cases of vesicular emphysema, and during intense paroxysms of spasmodic asthma, all respiration-sound may be locally deficient.

276. (b) *Alterations of rhythm. Jerking Respiration.*—When the movement of inspiration, instead of being accompanied by a sound continuous from the outset to the close (which may be represented thus), is attended with an interrupted one, divided into several unequal parts, (thus . . . | . . | . . . | . . &c.,) the respiration may be called *jerking*. The expiratory sound more rarely possesses this peculiarity, and, as far as I have observed, is scarcely ever affected alone; but it is generally somewhat increased in duration, while the inspiratory (if the moments, during which sound is actually perceptible, be alone considered) may be somewhat decreased in this respect.

277. Jerking respiration may be audible through the entire of one or of both lungs, when it deserves the name of *general*; this is very rare: or be limited to a certain spot, when it may be called *partial*. The former variety is observed in incipient pleurisy, pleurodynia, pulmonary and intercostal neuralgia, hemiplegia, spinal irritation, hysteria, and spasmodic affections of the air passages. The partial variety occurs in cases of solid lung-infiltration and of pleuritic adhesion.

278. *Cogged-wheel Rhythm.*—In some cases of incipient tuberculation the tidal air seems to struggle against minute obstructions in the finer tubes, whence a rhythm of sound resembling

that of a cogged wheel in rotation: it appears probable that glutinous mucus adherent to the walls, and which the air, in its flux and reflux, disturbs, without forming into bubbles, may be the cause of the phenomenon; the nature of the sound is rhonchoid, and it seems to pass into actual rhonchus in some cases.*

279. This peculiar rhythm is most commonly found in connection with tubercle; but I have observed it at one or both apices, when free from solidification of any kind.† Habitually almost limited to the inspiration sound, it may be most marked with expiration, and lose in distinctness in forced breathing.‡ It is often found at a consolidated apex, when fine liquid rhonchus exists at the base.§

280. *Decided Respiration*.—Instead of the two sounds, inspiratory and expiratory, succeeding each other so closely in each act of respiration that they may be considered continuous, they are sometimes separated by a distinct interval or pause: respiration of this rhythm I designate by the title *decided*. In advanced emphysema this separation of the sounds clearly appears to depend on the destruction of the walls of the air-cells, and the impaired elasticity of the remaining texture. In all the varieties of bronchial and blowing respiration there is a pause, more or less marked, between the two sounds; and I cannot impress too strongly on students, particularly on those who have difficulty in appreciating changes in quality and pitch, the importance of attending to this perversion of rhythm as an attribute of those forms of morbid breathing.

281. *Deferred Inspiration*.—In emphysema each inspiratory movement of the chest often commences, and continues for a brief, though appreciable interval of time, before sound is produced: the closing instants of the act only are attended with audible noise. The sound of inspiration may be said to be deferred.

282. *Unfinished Inspiration*.—Conversely, the inspiratory sound sometimes ceases, before the accompanying expansion of the chest: this effect may be observed in consolidations of various kinds.|| The phenomenon is rare, and I know not on what special

* M. Kenny, U. C. H., Females, vol. vii. p. 9.

† R. Smith (cutaneous cancer), U. C. H., Males, vol. vii. p. 376, or Med. Times, 1852.

‡ Tappin, U. C. H., Females, vol. ix. p. 83.

§ Simmons, U. C. H., Males, vol. ix. p. 57.

|| Thus, in very solid hepatisation, Shears, U. C. H., Males, vol. xv. p. 36.

condition of the consolidation it depends. Unfinished inspiration is always of harsh quality and heightened pitch.

283. *Altered Ratio of Inspiration to Expiration.*—Instead of the former of these sounds being to the latter very closely, as 3 : 1, in point of intensity and duration, the ratio may be converted into as 1 : 4. This enormous relative prolongation of expiration-sound is only met with in emphysema; but minor degrees occur in various indurated conditions of the lungs, and in pleuritic effusion and pneumo-thorax. I can scarcely believe that prolongation of the expiratory sound is capable of existing independently of other alterations, as I have never met with it to any well-marked amount without co-existing change of quality, of pitch, or of both. However, in some cases, the increase of duration is much more striking, and therefore, clinically, more significant than the other changes;—occasionally in tuberculisation, often in emphysema.

284. The signification of the expiratory sound was, in some degree, mistaken by its re-discoverer, Jackson [249]: he exaggerated its specific importance as a diagnostic sign of tubercles, and in this he has been very generally followed.* Many persons forget that what may appear in a given individual, as compared with another, prolonged expiration, is really in him a natural state;† some confound with it the pharyngeal expiratory sound; the normal existence of lengthened expiratory sound at the right apex of many females is habitually forgotten; and too few observers seem to be aware that, under whatever circumstances an obstruction exists to the free circulation of the air in the lungs, the expiration will be prolonged,—an obstruction which rarely, if ever, acts on the duration of the sound, without affecting some of its other properties. The fact of obstruction appears to me to account satisfactorily for the phenomenon. Expiration is, unless in exceptional persons, sonorous under all circumstances: where the reflux of the tidal air is rendered more difficult and slower than natural, the most natural consequence in the world is, that the attendant sound should be proportionally intensified and lengthened.

285. Diminished elasticity of the lung will, if there be obstruction superadded, produce the maximum prolongation, as in emphysema with bronchitis; very often, however, the sound spoken

* Students, especially in the early period of their career, are more frequently deceived by it than by any other sign easily ascertained, as the condition is, it is unfortunate it is not more significant.

† Vide Table (253).

of as prolonged expiration in this disease is nothing more than sibilant rhonchus,—true breathing-sound being totally absent.

286. (c) *Alterations of quality, pitch and rhythm combined.*—The morbid conditions of respiration falling under this head, are by far the most practically important, and may be arranged as follows.*

a. Harsh, bronchial.

a. Blowing	{	Simple . . .	{	diffused
		tubular		
	{	Hollow . . .	{	everted
		amphoric.		

287 (a). In *harsh respiration* both sounds have lost their natural *softness*; a peculiar *dryness* accompanies them; the breezy character of health is exchanged for one sharper and more blowing, which is generally more marked in expiration than inspiration. The *intensity* of the expiratory sound appears augmented from this superadded character; its *duration* is increased: both these latter properties may be, and commonly are, unaffected in the inspiratory sound. This type insensibly passes into the higher grade—*bronchial respiration*. Both sounds are now *rough* and *hard*, and notably more *dry* than in the natural state; the sharp blowing quality is heard in inspiration as distinctly as in expiration, and in the latter to a greater degree than in respiration of the previous type.† The *intensity* of both sounds appears increased, the *duration* of expiration is considerably augmented, and is even greater than in normal bronchial respiration: otherwise morbid breathing-sounds of this type closely resemble the natural sounds in the larger bronchial tubes.

288. In harsh respiration the expiratory sound commonly alone suffers change of quality; in the bronchial variety the inspiratory shares in the alteration. The usually earlier implication of the sound of expiration was first noticed by Jackson, and has since been insisted on by M. Fournet. This writer states that altera-

* This arrangement has been criticised as wanting in "simplicity." No one is a greater admirer of simplicity than myself, where it can be attained without sacrifice of accuracy. I simply join issue with those who assert it can here be secured by any less complicated division than that I suggest. What is practically gained by Skoda's very simple division of morbid respirations into "bronchial" and "indeterminate"? What idea does the word indeterminate convey? What sound does it help the observer to identify? An indifferent student would doubtless worship any "authority" prepared to go a step further and teach that the best, because the most simple, division, is into "healthy and morbid;" but would the diagnosis of disease benefit by the simplification?

† The expiratory sound may be, however, of lower pitch than the inspiratory, even where there is a considerable amount of condensation at the apices, e.g., Stammers, C. C. H., Females, vol. xi. p. 67.

tions in quality "always" set in with the expiratory sound, and only affect the inspiratory secondarily. With this statement I find that my own experience accords in respect of chronic affections, if the word "habitually" be substituted for "always:" I believe it to be correct also in the very great majority of cases of acute alteration of the parenchyma of the lungs. There is, however, a kind of rare bronchial respiration in which the inspiration alone suffers, the expiration retaining its natural properties; this seems to me insignificant in diagnosis, and rather to be an individual peculiarity of healthy breathing.

289. Harsh respiration, attending condensation or rarefaction of pulmonary substance, and dryness of the mucous membrane of the bronchi, is observed in incipient tuberculisation, dry bronchitis, vesicular emphysema, chronic pulmonary consolidation, dilatation of the bronchi, and incipient cancerous infiltration of the lung,—in cases where the lungs are slightly compressed by plastic or tuberculous matter in the pleura,—in the resolution stage of pneumonia,—at different periods of pleurisy, and in pulmonary apoplexy. Bronchial respiration is met with under all circumstances of slight condensation of lung-substance; unless, between the condensed part and the surface, there exist such quantity of healthy tissue as to mask the morbid sounds by its own natural ones,—or, unless fluid, solid, or gaseous accumulation in the pleura interfere with the conduction of the sounds.

290. (3) In *blowing respiration* both sounds are, as the name indicates, of blowing or whiffing character; and, in its most marked degrees, a sensation as if the air were drawn during inspiration from the observer's ear, or from the surface of the chest, and puffed back during expiration, is distinctly perceived. Both sounds are *rougher* and *harder*, and especially *more dry* than in altered states of less advanced type, and more or less *metallic*. The expiratory sound is of much *greater duration* than in the natural state: the inspiratory varies in this respect; both are more intense and of higher *pitch* than natural; and in both, *quickness* of production and progress constitutes, in the most marked forms especially, a characteristic feature. The *rhythm* is divided [289] from a halt between the two sounds,—not from the peculiarity I have called unfinished inspiration [282].

291. There are two main varieties of *blowing respiration*: the *simple* and the *hollow*.

292. *Simple blowing respiration* is commonly associated by writers with the bronchial variety. This seems an injudicious

attempt at simplification; for the two species not only differ in intensity, but in quality (mere bronchial respiration is never metallic), in quickness of evolution, and in pitch;—it seems, too, that the term bronchial should be limited to morbid respiration, simulating that naturally heard in the bronchial tubes.

293. Simple blowing respiration occurs in two forms,—the *diffused* and the *tubular*. If to the description above given be added the qualification that the whiffing sounds appear to be produced with but moderate intensity, and sometimes at a distance from the ear, over a tolerably extended space, the description of the *diffused* form will be completed. In the *tubular* form, on the contrary, the phenomena appear to occur in a space limited to the immediate neighbourhood of the part examined, and that space to be of tubular shape, cylindrical or flattened. The metallic character is highly developed, to such a degree that the sounds may, without exaggeration, be compared with those produced by blowing sharply through a brass tube: their *dryness*, *rapidity of production* and *intensity* are still greater than in the *diffused* variety. It is in the tubular variety, too, that the sensation of air being drawn from, and puffed back towards, the ear, is most distinctly marked.

294. The tubular form occurs in perfection in but one condition of lung, that of hepatisation; so true is this, that tubular and pneumonic breathing may be used as convertible phrases. But not unfrequently pneumonia runs its course without having produced true tubular breathing,—diffused blowing alone being audible. I had thought it probable, the *diffused* blowing respiration is transmitted from a number of small bronchi, the *tubular* from a few large ones. Were this the case, the change in character from *diffused* to *tubular blowing* would be referrible to the compression and obliteration of the smaller bronchi, corresponding to the increase in extent and the amount of solidification, and would account for the fact, which may, I think, be frequently observed, that the well marked *tubular* form signifies a more advanced degree of disease than the *diffused*. But this explanation will not, at least always, hold; the consolidation may be very extensive and dense and the true tubular quality nevertheless be wanting.* Less perfect tubular breathing is heard in cases of pulmonary abscess, or solid accumulation of moderate size, near the large

* Shears, *Males*, vol. xv, p. 85. Where the respiration is very frequent, the pitch of the sounds is generally higher than in the diffused variety, even though the solidification be only moderately dense.

bronchi. The diffused form occurs, or may occur, in all conditions of diffused solid consolidation, intra or extra-pulmonary, simple, tuberculous, carcinomatous, fibro-fatty, &c., and in dilatation of the bronchi. There is, besides, a condition under which I have frequently observed the diffused variety of blowing respiration, and where it is likely, unless the examination be conducted carefully, to deceive the observer. In certain cases of tuberculous excavation, auscultation may have been performed in two or three places at the apex without cavernous respiration with the hollow metallic character being discovered, the diffused variety of blowing respiration being the condition observed; yet at some other spot, close by, that variety of breathing may at length be detected, and so one evidence of excavation established. In these cases the cavernous character is evidently masked by the diffused blowing, which is the result and exponent of the condensation existing around the excavation. This is one reason why a cavity may escape discovery, unless the examination of the chest be very carefully performed. On the other hand, in certain cases of pneumonia of the anterior apex, of tumor connected with a large bronchus, and of dilated bronchi, true blowing respiration may acquire a hollow character, and hence simulate cavernous breathing.

295. Lastly, in pleuritic effusion, if there be adhesion or agglutination of the pleura, respiration of the diffused blowing type, often sufficiently marked to suggest the idea of hepatisation, is more or less extensively audible; the presence of condensed lung near the surface sufficiently explains its existence. But it is not alone in these cases of adhesion, that blowing respiration may attend pleuritic effusion; it may be present where no adhesion exists, and the effusion is abundant. It does not, as far as I have known, pass into the tubular variety under these circumstances, is never intense, and in the majority of cases, very feeble, especially when compared with the amount of percussion-dulness present; it is also distant from the ear except in the close vicinity of the spine, and generally limited to the middle height of the back—in other words, to the neighbourhood of the main bronchi: in some cases it has all the characters of, and is obviously, transmitted pharyngeal respiration.

296. The theory of bronchial and blowing respiration commonly admitted, regards it as transmitted natural bronchial breathing. Either the sounds of the air-current in the larger bronchi of the solidified lung, or (inasmuch as the respiration-play of that organ is more or less diminished, and therefore little or no flux and reflux

of air can occur even in its medium-sized tubes) the sounds of the air-current in the trachea and in the main bronchi of the non-affected lung, are supposed to be conveyed thence through the hepatised tissue with an intensity varying directly as the increase by consolidation in its conducting power. Three objections occur to me as negating either explanation,—or at least as proving their inadequacy: the sounds in pneumonic tubular breathing habitually differ in quality and pitch from those of the trachea and larynx; they are commonly much stronger than the latter; while in some rare cases of perfect consolidation, without obstruction of the main bronchus, there is dead silence over the hepatised structure. The conducting power, in regard of breathing-sounds, of hepatised tissue removed from the body, I have found by experiment to vary inexplicably.

297. Skoda^a appears to hold that the laryngo-tracheal sounds and those of both main bronchi consonate in the air contained within the bronchi permeating the consolidated parenchyma, and thus produce the phenomenon of bronchial respiration, when intense and of high pitch; whereas weak bronchial respiration of low pitch comes directly without consonance from the lower part of the trachea, the main bronchus, or one of those of second order. It seems doubtful whether this theory can be the true one; for the pitch of metallic pneumonic respiration is irregularly higher than of the laryngo-tracheal, whereas consonating sounds are always either of the same pitch, or of pitches bearing a certain harmonic relation to each other.

298. The difficulties to be explained are obviously: the greater intensity of the thoracic than of the tracheal breathing-sounds, and the irregular differences in their relative pitch. As the same difficulties occur, and appear similarly explicable, in the theory of morbid resonance of the voice, the reader is referred to the discussion on the latter subject [421—442].

299. The essential peculiarity of *hollow* respiration is signified by its name. It is of two kinds, differing only in scale,—cavernous and amphoric, small and large.

300. In the *cavernous* kind the ear receives the impression most distinctly of connection with a hollow space; the *character* of the sounds is *hollow*, whiffing, and moderately metallic; their pitch lower than in tubular breathing,—the expiration sometimes higher, by far more commonly lower, pitched, than the inspira-

^a Auscultation, vierte Auflage, pp. 91 and 104.

tion.* The peculiar *quickness* of production is less marked than in either kind of simple blowing respiration,—there seems to be a delay in the interior of the chest. Cavernous respiration, though rarely, is sometimes attended with the sensation of air being drawn from the surface and puffed back again,—the peculiarity appearing to announce the close vicinity of the seat of the phenomenon to the surface.

301. The veiled puff (*souffle voilé*) is a modified cavernous respiration, in which a “sort of moveable veil interposed between an excavation and the ear” seems to be agitated to and fro: such is Laennec’s description of a phenomenon so rare, that I had never, until quite recently, met with it.†

302. Globularly and largely dilated bronchial tubes, and excavations in the substance of the lung (the less fluid they contain, the more solid their walls, and the freer their communication with the bronchi, the better) give cavernous respiration. Tuberculous excavation is by far its most frequent cause,—cavities produced by gangrene, abscess, cancer, pulmonary apoplexy, and intra-thoracic purulent collections perforating the lung, much rarer ones.

303. The mechanism of cavernous respiration is probably of at least two kinds. If the influx and efflux of air into and from the hollow space concerned be free, the quality of the sounds is simply explicable by the form of that space. If from rigidity of the thoracic walls, or other physical impediments, the cavity itself can scarcely be supposed the seat of active movement of air, the cavernous quality is probably that of the neighbouring bronchial breathing modified and reinforced within the excavation. Among the physical conditions most favourable to the perfect development of the different varieties of blowing respiration, is absence of solid or fluid in the space where they are actually produced, and from which they are transmitted to the ear. This is true of all the varieties; and hence true, whether the seat of the phenomenon be the bronchi, a pulmonary excavation, or the pleural cavity communicating by a perforation with the bronchi. If the bronchi or pulmonary cavity contain fluid, the tendency will be to the production of various liquid rhonchi instead; and hence the phenomena of cavernous rhonchus and cavernous

* It has been suggested by Dr Flint that bronchial respiration may be always distinguished from cavernous by the relative pitch of inspiration and expiration, — the latter higher than the former in bronchial [287], lower in cavernous breathing. Exceptions are so common, I fear, as to render this alleged rule unworthy of trust.

† Tagg, U. C. H., Females, vol. ix. p. 108.

respiration are habitually in the inverse ratio of each other, as regards degree and perfection of development. If an excavation be partly filled with fluid and partly with air, the possible conditions are of three kinds: *a.* When the quantity of liquid is small, and the bronchus communicating with the excavation opens above the level of the liquid, pure cavernous respiration will be heard: *b.* When the communication with the bronchus occurs below the surface of the liquid, cavernous rhonchus is heard alone: *c.* When a double communication exists, that is, above and below the surface of the fluid, cavernous rhonchus and respiration will both be present. But it must be confessed, although all this has been *observed* by myself and others, the cases are rare in which such nice discrimination can be effected.

304. The cavernous quality is often, confessedly, deficient, where excavations actually exist. Is it ever present when they are absent? Unfortunately in regard of the facility of diagnosis, my existing experience obliges me to answer this query with an emphatic, Yes. Over certain solidifications surrounding bronchi not necessarily even modified in calibre, there may exist at once the breathing, the rhonchus, and the vocal phenomena commonly associated with, and commonly supposed peculiar to, actual excavation in the lung-substance. I have observed this both in fatal and in cured cases of pleurisy* and pneumonia,†—the phenomena disappearing in the cases of recovery in such manner, as to prove the total absence of any loss of pulmonary substance,—which in truth had never been even remotely suggested except by the physical signs. The bronchi, blocked up at one end, might be assimilated to as many elongated cavities, and so a form of explanation found,—but only to be rejected; for were it correct, these quasi-cavernous phenomena ought to be the rule, instead of the rare exception, in solidification either by pressure or infiltration. Evidently some accidental condition occurs,—probably a mode of localisation of the indurated tissue, causing it to form a direct solid link between the root of the lung and the surface examined.‡

305. Shall we then reject cavernous respiration as a variety, and blot out the term from our phraseology? No. For

* Foubury, U. C. H., *Males*, vol. ix. pp. 350—352; E. Smith, U. C. H., *Males*, vol. xi. p. 135.

† Wright, U. C. H., *Females*, vol. xv. p. 14.

‡ This important matter will be further discussed with the subject of Pleurisy.

auscultation, as an art, is based on the sole teachings of the ear; and the cavernous character is real, as an auditory impression. We will simply bear in mind that there are certain rare physical states, rudely imitating excavation of the lung, which furnish, as might be expected, respiration-sounds resembling those of an excavated space; and others still rarer, where the explanation has yet to be established.

306. The *special character* of the *amphoric* kind is derived from the attendant sensation of air passing into a large empty cavity having dense walls—such as is perceived on blowing into a water croft. It is strongly metallic, and sometimes, but rarely, associated in one and the same respiration with metallic tinkling.* The amphoric character accompanies both sounds, but especially the expiratory, though occasionally more markedly the inspiratory; in some instances it only appears on forced breathing; in rare cases it may be heard even at a distance from the chest.† Commonly audible at the middle height of the thorax, rare at the upper part, and yet rarer at the base, its physical cause and theory are much the same as of cavernous breathing; the cavity concerned is simply larger.‡ Hence it may exist in tuberculous or other excavations in the lung, but they rarely combine the necessary conditions; broncho-pleural fistula with hydro-pneumothorax is its common anatomical cause, whether produced, as is by far most usual, by tuberculous perforation of the lung and pleura, or by perforation of the lung attending the transit of pus either from the pleural sac or from distant parts. The communication with the bronchi must, for perfection of the sign, be above the level of any fluid in the echoing cavity.

B.—*Adventitious sounds, produced within or about the thorax
by the act of breathing.*

307. The essential difference between the morbid states of respiration hitherto considered, and those now to be described, is, that, in the former, modifications only of a natural sound exist, while in the latter there is actual generation of new phenomena. These adventitious sounds may be produced in: (a) The air-passages, or cavities communicating with these; (b) The lung-

* Reilly, U. C. H., *Malac.* vol. xvi. p. 168, -pneumo-thorax.

† In a case by Louis (*Phthisie*, 2^eme édit. p. 496) at 2½ inches distance.

‡ It does not however necessarily follow that where amphoric respiration exists, the excavation is of large size—one of moderate dimensions will suffice, provided the surrounding substance be extremely solid, and closely bound to the costal surface.

substance; (c) The pleural cavities; (d) The mediastina; (e) The thoracic parietes; (f) The neighbouring organs.

308. (a) *Adventitious sounds originating in the air-passages (rhonchi or rattles).*—A rhonchus may be defined as an adventitious sound, audible in inspiration or in expiration, or in both; of dry or moist character; masking the natural breathing more or less completely; persistent or intermittent; originating in the air-cells, the minute or the larger bronchi, the trachea or larynx, and in excavations of the pulmonary substance; and produced either by the passage of air along bronchi of altered calibre, by air bubbling through fluid contained in the sites mentioned, or by the vibration of semi-solid plastic matter in the tubes, or of prominent folds of their own lining membrane.

309. The audible characters of rhonchi divide them into the following genera and species:—

Whistling	{	high-pitched.	
		low-pitched.	
Crepitating			
Crackling	{	dry.	
		moist.	
Bubbling	{	small.	{ simple.
		large.	{ hollow.

310. Whistling rhonchus is either of high or low pitch,—in the former case called *sibilant*, in the latter *sonorous*.

311. *Sibilant* rhonchus is dry-sounding; commonly co-existent with both inspiration and expiration, but especially marked in the former, and occasionally limited to either, it varies much in intensity and duration; recurs irregularly, instead of accompanying every respiratory movement; and is high-pitched,—sometimes so much so, as to be *hissing* in character.

312. Laennec taught that the sibilant rhonchus of acute bronchitis depended on diminution of the calibre of the bronchi, caused in turn by inflammatory thickening of their lining membrane and sub-mucous tissue. The characteristic intermittence of the rhonchus argues strongly against this notion, as the thickening of tissue must be a persistent state; and it is further opposed by the fact that whistling rhonchus may be interrupted and silenced for a variable number of respirations in any given spot, by causing the patient to cough. Coughing, we can readily understand, will alter the position of viscid mucus; but it cannot be supposed to have any direct and immediate influence on the thickness of the mucous membrane, or, scarcely, even on the conditions of a

vibrating fold of its substance. The rhonchus, though dry to the ear, clearly depends on the influence of air on fluid, and may be imitated by blowing through saliva between the lips at a certain amount of separation.

313. When the cause, at least remote cause, of the sibilant rhonchus is of a permanent nature, as diminished calibre from the presence of a tumor, it is said that the rhonchus is itself permanent. But I have, even in cases of this kind, found that the morbid sound will be altogether removed for a while by the act of coughing; and hence believe that the altered form of the bronchus has less to do with the production of the rhonchus, than has the existence of local accumulation of viscid mucus, whether this be a mechanical result of the pressure of the tumor, or the effect of circumscribed supersecretion. If this notion be correct, it is manifest that rhonchi of this class have no claim in respect of their mechanism to the title of dry; the impression made upon the ear alone justifies the application of the term.

314. *Sonorous rhonchus*, varying in special character, is always marked by heaviness of tone and dryness; usually co-existing both with inspiration and expiration, but especially marked in the latter, to which it may be limited; varying in intensity from a very slight sound to one loud enough to be audible at some distance from the chest, and to be attended with thoracic fremitus over a surface of variable extent; varying in duration, but having a natural tendency to prolongation; continuously and steadily evolved, unless of very short duration, when it is produced in a quick and abrupt manner; occurring interruptedly, or, in rare instances, attending every successive respiration; and sometimes alternating with the sibilant or with bubbling rhonchus.

315. The special character of the sonorous rhonchus varies; it may be *snoring, rubbing, or cooing*.

316. To resume: the essential cause of whistling rhonchus is the vibration of secretion in the tubes—viscid mucus, plastic substance, &c.: in certain positions it may be produced by the vibration of a thickened fold of the mucous membrane itself: irregular and instantaneous spasm of the smaller tubes frequently induces it, by narrowing abruptly the diameter of the passages through which the air moves; as, conversely, relaxation of that spasm instantly removes it [*vide* ASTHMA]: lastly, it may in some instances indirectly proceed from permanent constriction of the tubes, caused either by disease of their coats or by pressure from without.

317. As a general rule, the low-pitched sonorous rhonchus originates in the large, the high-pitched sibilant in the small, the very acute hissing in the minutest, bronchi. But, as large tubes may, practically speaking, be made small ones by disease, sibilant may and does occur in bronchi of second and third orders.

318. *Crepitating* (or *crepitant*) rhonchus, when developed in perfection, occurs in puffs more or less prolonged, but rapidly evolved, composed of a variable, sometimes immense, number of sharp, crackling sounds, all perfectly similar to each other; conveying the notion of minute size; dry; co-existing exclusively, except in rare cases, with inspiration; and, once established, remaining a persistent condition until superseded by other phenomena.

319. The most accurate comparison which has been made between the crepitant rhonchus and any other species of sound seems to me unquestionably that of Dr. Williams, who likens it to the noise produced by rubbing slowly and firmly between the finger and thumb a lock of one's hair near the ear. In every respect, both as regards the crepiti themselves and the entire act of crepitation, the similarity amounts almost to identity; but it must be remembered that it is to perfect crepitation, and to this alone, the comparison is to be understood to refer. Dryness is one of the best marked acoustic properties of true crepitation; the sensation is not that of bubbles bursting, but rather of delicate tissue undergoing minutest ruptures with a crackling noise in many points simultaneously.* Again, rapidity of evolution is an important property of crepitant rhonchus, and among other characters serves to distinguish it from the small bubbling species; the crepiti appear to be nevertheless successively produced in tissue nearer and nearer to the ear. So, too, persistency is a feature of some importance as distinctive of crepitant rhonchus: other rhonchi are manifestly influenced in the regularity of their production by the occurrence of expectoration, for example; but over true crepitation this appears to exercise no control. The first effect of a fit of coughing, indeed, is to render the rhonchus more distinct and abundant even than before; deep inspiration produces the same effect: under both circumstances parts of the lung, passive in ordinary breathing, are suddenly expanded.

320. When at its maximum crepitant rhonchus accompanies almost the entire act of inspiration; when first developed, and

* And yet, as we shall by-and-by see, liquid of the thinnest possible kind may play an essential part in the generation of the sound [324]

also when about to be superseded by blowing respiration, it appears towards the close of inspiration only. Under all circumstances it is, to say the least, rare to find this rhonchus co-existent in any degree with expiration; the statement that it may generally be heard to a diminished amount with this division of the respiratory act, appears to me to have originated in the confusion which long prevailed between the crepitant rhonchus of pneumonia and the small bubbling rhonchus of capillary bronchitis.

321 The mechanism of this rhonchus is yet undetermined, and its consideration implies that of certain phenomena themselves involved in obscurity, namely:—*a.* The intimate seat of production of the rhonchus; *b.* The physical condition of that seat at the moment of production. It has been said (*a.*) the cavities of the pulmonary cells are the seat of the rhonchus; because:—1. The rhonchus is evidently a diminutive of the finer mucous bubbling species, which is confessedly produced in the smaller bronchi: the comparatively small size of the "bubbles" is explained by the less calibre of the cavity in which they are evolved. 2. The "bubbles" are extremely small and numerous, and equal in size, like the cells themselves. 3. In old people the "bubbles" are larger than in adults, just as the cells are of enlarged dimensions from the process of atrophy which the lung has undergone. 4. In infants, on the contrary, the "bubbles" are sometimes of extremely minute size, and in infancy the cells of the lung are well known to be proportionally small. 5. The shape of the "bubbles" appears to furnish an exact representation of that of the cells. But these arguments are not convincing. In the first, the question is begged, the difficulty is to ascertain whether the rhonchus is a diminutive of the mucous. 2. The sounds convey the notion of minute and of equal size, it is true, but this is no proof that they originate in the cavity of the cells. 3. The alleged fact is probably correct, and is connected no doubt with the atrophy which commonly exists in individuals of advanced age, but this atrophy may be understood to modify the rhonchus, without the seat of this being necessarily admitted to be the interior of the cells: the parenchyma too is looser in aged persons. 4. Against the correctness of this statement I must express myself most strongly. I have never yet heard a crepitant rhonchus having as much of the character of minuteness in the infant as in the adult individual, and, indeed, the non-development of the true primary rhonchus in children of very tender age is a fact familiar to all auscultators. 5. The notion respecting the "bubbles" seems to be an illusion; and its want of import is rendered sufficiently obvious by the circumstance that the best imitation of the crepitant rhonchus is furnished by rubbing a lock of hair firmly between the fingers. The real existence of "bubbles" is similarly shown to be, at the least, a matter by no means proved by the character of the rhonchus. For these reasons, I am disposed to believe that the development of the crepitant rhonchus in the interior of the vesicles may legitimately be questioned.

322 (*b.*) The passage of air through liquid contained in the cells is commonly believed to be the physical cause of the rhonchus; but writers differ respecting the consistence of the fluid. 1. Some maintain that it is of aqueous or serum consistence, founding their belief upon the state of the liquid expressed from the lung after death during the first stage of pneumonia, and upon the fact that it is found experimentally, the more viscid the fluid through which air bubbles, the less perfect will be the similarity of the noise produced to the crepitant rhonchus,—to such a degree, that when pure mucus is employed, no crepitant sound is produced at all. 2. Others maintain that the perfection of the crepitant character depends on the fluid through which air bubbles being viscid in a high or at least a noticable degree. Each of these opinions is supported by experiments and arguments subversive of each other: but there is a more urgent reason for discrediting the notion that the consistence of the secretion occupying the cells exercises material influence upon the rhonchus: namely, that both the ordinary true crepitant and the exceptional fine bubbling rhonchi occurring in pneumonia coexist with expectoration of various degrees of liquidness or viscosity.

323 It appears inferrible, from what has now been said, that the theories of the mechanism of the crepitant rhonchus hitherto proposed cannot be considered satisfactory. It is unfortunately easier to make this manifest, than to substitute a less

objectionable one in their room. It seems, however, most probable, that the phenomenon occurs in the parenchyma of the lung itself, especially in those portions of it immediately contiguous to, and actually forming the walls of, the ultimate terminations of the bronchi, and that its physical cause is the sudden and forcible expansion of that parenchyma, glued together, as it were, by the viscid exudation with which it is infiltrated. Each single crepitus or click would thus signify the expansion of a cell, and be produced by the unfolding of surrounding glutinous tissue necessary for that expansion. Thus conceived, as respects its mechanism, the chief phenomena of the crepitant rhonchus become perfectly intelligible—its dryness and sharpness, the sensation of minute size attending the sounds—of which it is composed, the similarity to the sound of minute ruptures of tissue, and the total absence of the bubbling character; its occasionally accompanying the entire inspiratory act, and sometimes appearing only at its close, according as the infiltration of viscid lymph less or more completely prevents expansion of the vesicles. We can on this supposition also readily understand why crepitation should exist in inspiration only, though the rapid and abrupt unfolding of the glutinous mass be productive of crackling noise, it is very unlikely that the comparatively slow and equable restoration of the tissue to its previous collapsed state would be thus productive,—indeed the presumed physical cause of crepitus would have ceased to exist. On the other hand, there is no reason why on the ordinary theory crepitation should not as regularly exist, though not with the same loudness, in expiration as in inspiration. The air is presumed to have passed through a certain fluid, if so, it must re-pass through it during expiration, and usually with a noise similar in kind, though less in degree, when rhonchi are manifestly produced by the passage of air through liquid, they attend both inspiration and expiration. Further, the nature and mechanism of pleural, mediastinal and intra-parenchymatous pseudo-rhonchi support the views here taken.

324. But I cannot put forward this theory as wholly unopen to objection,—at least as far as the glutinous quality of the adventitious material is concerned. For though, as matter of clinical experience, the combination of rhonchal characters described is almost peculiar to the early stage of pneumonia (whether this depend on any specificity of the fluid in that disease, or on the rarity with which the actual air cells and adjacent parenchyma contain fluid in other affections), still I have heard crepitant rhonchi of typical perfection in a few instances where post mortem examination proved the purest watery edema to be the sole morbid condition. I have not met with true crepitation in pulmonary apoplexy or in the hæmoptysis either of phthisis, cirrhosis or plastic bronchitis.

325. *Crackling rhonchus* is *dry* or *moist* in character.

326. The *dry crackling rhonchus* is composed of a succession of minute, dry, short, sharp, crackling sounds, few in number, rarely exceeding three or four in a respiration; coexisting exclusively, or almost exclusively, with inspiration, though in very rare cases most obvious in expiration, especially when it has existed for some time; permanent, in the great majority of cases, after its characters have once been perfectly developed, until it ceases altogether to be produced, in consequence of its passing into the moist variety; and usually conveying the impression to the ear of being evolved at a distance from the surface.

327. In stating that the dry crackling rhonchus, once perfectly developed, remains commonly a persistent condition until the transition into the moist form is established, I wish to lay particular stress on the circumstance of its being so developed. While yet producible only by forced respiration, and appearing only with an occasional inspiration, it is liable to disappear for a day or two, and then recur; but when once it has acquired sufficient perfection

and stability to maintain itself steadily through a number of ordinary respirations, it apparently constitutes a persistent state.

328. This rhonchus, though its mechanism be unexplained, is not without diagnostic importance. It is of tolerably frequent appearance on the eve of the softening process in tubercles, and may hence by possibility be discovered wherever that product exists in the first stage,—but is most common in the infra-clavicular, or supra-scapular regions,—especially in the former. Its natural course is to pass into moist crackling; and, according to M. Fournet, in cases of acute phthisis, the transformation occurs in the majority of instances in from eight to twenty days: in from twenty days to two months and a half, or three months, in the chronic form of the disease. These statements respecting time must be received with caution, however, and are subject, as admitted indeed by this writer himself, to very distinct exceptions.

I do not, however, coincide with those who look upon this rhonchal sound as actually distinctive of tubercle,—at least, I am very certain it is occasionally to be heard in bronchial irritation of the apex, where the subsequent progress of events very clearly disproves the fact of tuberculation. My opinion has changed in regard to the significance of this sound, just as it has concerning the allied phenomenon, cogged-wheel rhythm [279].

329. *Moist crackling*.—A rhonchus composed of a series of clicking sounds,—few in number,—of moderate size,—occurring during both respiratory movements, but with greater regularity and distinctness of character in inspiration, and eventually passing into, or rather superseded by, rhonchi of the bubbling class.

330. Although this rhonchus may most commonly be connected clinically with incipient softening of tubercle, its mechanism is almost as obscure as that of the dry crackling. It appears rather to be produced in direct connection with tuberculous matter, which has commenced to undergo softening, than to constitute a mere form of bronchial rhonchus, having its seat in the bronchi, and produced by bubbling of air through mucus. The clicking character it possesses, combined with the special nature of the anatomical conditions which it is known to attend, points to a peculiarity in its mechanism. Possibly it originates in the interior of softening tubercles which have just commenced to communicate with the minute bronchi. If so, its “conversion” into bubbling rhonchus would in reality be nothing more than its being superseded by that state.

331. I do not by any means believe, however, as taught by Fournet

and others, that it is possible to distinguish with certainty by the ear this rhonchus from crackling sounds produced in the smaller bronchi, when surrounded with hardened tissue.

332. *Bubbling* rhonchus is *simple* or *hollow* in character. The simple kind varies in the size of its component bubbles, which are *small* or *large*,—a subdivision of clinical significance.

333. In *small-sized bubbling* (sub-crepitant) rhonchus, the component sounds have a distinctly bubbling character; they are of moderate size; humid; scarcely ever occur in puffs; are evolved with variable quickness, but rarely with much rapidity: are few in number and dissimilar to each other; occur with more or less irregularity; and attend both respiratory movements. The bubbles vary in size and liquidness.

334. Produced by bubbling of air through liquid of variable consistence in minute bronchial tubes, this rhonchus, if occurring at both bases posteriorly, indicates idiopathic capillary bronchitis, if at either apex, diathetic bronchitis,—if at one base, posteriorly, it most commonly depends either on pneumonia in the stage of resolution, or on bronchitis attending tubercle of the *upper* lobe, though occasionally connected with emphysema in excess on the same side. With very liquid bubbles it occurs in various parts of the chest from pulmonary apoplexy,—at both bases posteriorly from idiopathic or post-pneumonic cedema. Auscultators are indebted to M. Louis for establishing its frequency, at both bases, as a sign of capillary bronchitis.

335. In the *large-sized bubbling* rhonchus (so-called *mucous*, *submucous*, &c.), the bubbles are of unequal size, but all materially larger than in the last described species, variable in number,—distinctly liquid,—irregular in recurrence,—modified by the acts of coughing and of expectorating, and coexistent with both respiratory movements. The size of the bubbles commonly localises the rhonchus in the larger or smaller bronchi: yet not always, as fine rhonchus may, by possibility, form even near the bifurcation of the trachea.

336. Caused by bubbling of air through liquid (mucus, serosity, blood, pus) contained in tubes of moderate or considerable calibre, and most commonly audible towards the central parts of the lungs, this rhonchus attends the secretion-stage of bronchitis, bronchorrhœa, dilatation of the bronchi, bronchial hæmorrhage, hæmoptysis, evacuation of pus from the pleura or elsewhere through the bronchi, and occasionally, the softening stage of pneumonia.

337. *Hollow bubbling rhonchus* (cavernous or gurgling), consists

of a limited number of bubbles of large size, distinctly liquid, occasionally disappearing for a time, having a peculiar hollow ringing metallic character, and co-existing commonly with inspiration and expiration,—in some cases with either alone,—and associated or not with cavernous respiration. The size of the bubbles varies; whence the rhonchus has been called *amphoric*, *cavernous*, and *cavernulous*. In the last and smallest there is distinctly a ringing metallic character, but the sensation of hollowness is not perceived, or at least imperfectly. Cavernous rhonchus may be sometimes heard at a distance from the patient's chest.

338. The causes of the temporary cessation of cavernous rhonchus, just enumerated among its characters, are—1. Complete evacuation of the liquid contents of the space in which it is produced; under these circumstances it is replaced by cavernous respiration; 2. Diminution of the fluid contents to such extent as to bring the level of these below the bronchial opening or openings into the cavity; 3. Absence of air in the cavity, the entire space being filled with fluid; 4. Obstruction, by inspissated muco-pus or otherwise, of the bronchi communicating with the cavity; 5. Pressure of the lung by pleuritic effusion,*—a very rare cause, seeing that the surface of the excavated parts is almost invariably agglutinated to the costal pleura.

339. Whenever bubbles burst in a hollow space within the chest, the resulting clicks resound and may, further, be echoed by the walls of that space,—the harder and smoother the walls, the more perfect the reinforcement by unison-resonance, and the more certain the occurrence of echo [433]; the softer and more rugged, the less perfect and the less certain. So true is this, that excavations of small size, and surrounded with even tolerably healthy parenchyma, furnish no real hollow rhonchus,—the bubbles form and burst, but their clicks are not reinforced nor echoed. The common cause of bubbling is, of course, the passage of air in and out of the excavation; and, according to the relative position of the contained fluid and the communicating bronchi, will the period of the acts of respiration, at which the rhonchus is best heard, vary. The bubbles may sometimes probably burst at the bronchial orifices, and then echo within the cavity. Besides this, a species of gurgling, resembling cavernous rhonchus somewhat, and becoming metallic in quality, if the mouth be held open, may be produced in large cavities from the agitation of their contents

* Stafford, Consumption Hospital, Chelsea, in "Lancet," July, 1844.

by the impulse of the heart.* I have only heard this in the left lung, but Dr. Stokes has observed it in both, and even in the posterior portion of the right lung, producing a "tick loud enough to reckon the pulse by." Under all circumstances it is rare,—even when the heart and cavities are closely contiguous.

340. Excavations from tubercle are, of course, the most common anatomical state present; but those of abscess, sphacelus, softened cancer, pulmonary apoplexy, and perforating empyema, Ac., as likewise dilatations of the bronchi, may be the seat of the phenomenon.

In an emaciated middle-aged man, whose history pointed to abscess in the neighbourhood of, and opening into, the œsophagus, there was audible under the right clavicle large-sized thin ringing rhonchus,—gurgling, but not metallic. The possibility of communication having taken place between the abscess and œsophagus on the one hand and a large bronchus on the other, suggested itself; and this diagnosis, supported by a non-phthisical history and the existence of fairly pulmonary percussion-note under the clavicle, proved correct.† But had there been any deficiency of infra-clavicular resonance,—or had the previous events been reconcileable with the idea of phthisis, I do not see how error could have been avoided.

341. *Dry crepitant rhonchus with large bubbles*, "observed only during inspiration, conveys the impression as of air entering and distending lungs which had been dried, and of which the cells had been very unequally dilated, and entirely resembles the sound produced by blowing into a dried bladder." Such is Laennec's description of a "rhonchus" which he believed peculiar to emphysema, pulmonary and interlobular; the phenomenon is excessively rare, and cannot be correctly spoken of as a rhonchus,—it is rather a form of respiration, distinguished by dryness and crispness, and is totally wanting in bubbling character. It mainly indicates the existence of dry distended pouches under the pulmonary pleura, —the most advanced condition of pulmonary emphysema. In the few instances in which I have heard the sound, it was transitory.‡

342. Under the title of "consonating," Skoda describes a rhonchus, clear, high-pitched, and unequal-bubbled, accompanied

* Jamieson, C. C. H., Males.

† Post-mortem examination made by Mr. W. Groves. Two of these openings in the œsophagus communicated directly with the right main bronchus.

‡ Hayes, C. C. H., Females, vol. v. p. 24; Quinlan, C. C. H., Females, vol. xiv. pp. 40, 41.

with resonance, which is, however, neither metallic nor amphoric. It is found along with bronchial breathing and broucophony, and generally signifies pneumonia or tuberculous infiltration. This description would answer to bubbling rhonchus, produced in tubes surrounded by solid tissue, and intensified, as possibly may be the case occasionally, by unison-resonance [421-442].

343. (*b*) *Adventitious sounds originating in the lung-substance (pulmonary pseudo-rhonchi).*—If individuals, whose lungs are healthy, or diseased only at the apices, and whose breathing is habitually calm, are made suddenly to respire deeply, a peculiar, fine, dry crepitation, accompanying inspiration only, may often be detected at the bases posteriorly. But after two or three, or at most five or six, acts of respiration, it either totally or almost totally disappears. This pseudo-rhoncal sound seems to depend on the sudden and forced unfolding of air-cells, which are unaffected by the calm breathing habitual to the individual; and its only importance arises from the possibility of confounding it with crepitant rhonchus.

344. Here we have a minor degree of the phenomenon observable in the same regions, when any considerable portion of the base of the lung is under the influence of persistent pressure from tumors or enlarged abdominal organs.—I mean the *pulmonary compression pseudo-rhonchus*,* which consists of a series of fine, very dry crepiti, evolved at a peculiarly slow and drawing pace, variable in number, but generally very numerous, and commencing towards the close of inspiration, or in some cases apparently when this movement has almost ceased.

345. This sound of unfolding lung varies in quality, if the lung be diseased. Thus, in a case of arrested phthisis, at the apex of the lung, where, nine months before, softening signs were most manifest, I have recently found toneless percussion, feeble bronchial breathing, and a deep-seated creaking noise accompanying inspiration: in all probability the unfolding of induration-matter in the lung is the cause of this sound. I have repeatedly observed this sign, without having traced the progress of its development so well as in this instance.

346. (*c*) *Adventitious sounds in the pleura.*—Daily experience proves that the collision of the opposite laminae of each pleural sac, during inspiration and expiration, is not in the healthy state productive of appreciable sound. Experiments upon the lower

* Clinical Lectures, Lancet, 1849, p. 525, in case of enlarged liver; also in case of enlarged spleen, . . . Dujardin, U. C. M., Males, vol. v. p. 110.

animals might, were this necessary, be referred to in confirmation of the fact. This noiselessness of movement of the pleural surfaces upon each other depends at once upon their perfect smoothness and slight humidity, and upon the statical laws of the breathing apparatus which ensure the surfaces from mutual pressure. When these conditions become changed by disease, the gliding motion is attended by different modifications of sound, varying with the nature and amount of the existing anatomical change. While these different sounds all agree in being produced by friction, some of them, also, convey this sensation to the observer, and are, therefore, commonly designated as *pleural friction-sounds*.

347. *Pleural friction-sound* consists either of a single, or, more commonly, of a series of abrupt jerkily produced noises, few in number, and manifestly superficial in seat: it is audible over a variable, but usually limited extent of surface; persistent or intermittent; of variable, but commonly more or less considerable duration: ranging, in point of intensity, from a scarcely audible noise to one of extreme loudness; attended with a sensation of dryness; almost invariably heard in inspiration, and habitually, but by no means always, more intensely developed with that movement,—most frequently accompanying both inspiration and expiration, seldom expiration alone;* produced with ordinary respiration, or only after coughing, or by deep inspiration; in strongly-marked cases attended with fremitus palpable to the hand, and perceptible to the patient, and sometimes increased by pressure with the stethoscope. Calm, may give more friction-sound than forced, respiration.†

348. The species and varieties of intra-pleural noises may be arranged thus,—the mechanism of each species is different from that of the rest:—

- (a) *Attrition*; 1, grazing; 2, rubbing; 3, grating
- (b) *Creaking*.
- (γ) *Crackling*.
- (δ) *Rumbling*.

349. (a) *Attrition species*.—1. The *grazing* variety, the most delicate form of friction, is usually a single sound; audible over a very limited extent of surface; occurring with an occasional

* Clanney, U. C. H., *Males*, vol. viii. p. 73. Total limitation to expiration is of temporary duration. Friction sound may also be most prolonged, and consist of the greatest number of jerks in expiration, e.g., Humbert, U. C. H., *Males*, vol. ix. p. 14; Bassett, U. C. H., *Females*, vol. vii. p. 226.

† Bassett, U. C. H., *Females*, vol. vii. p. 224.

respiration only : remarkable for mobility ; more rapidly evolved, and of less duration than the other varieties ; dry and limited strictly to inspiration. Changing from hour to hour, it may be, in precise site, this variety is almost peculiar to the dry period of pleurisy, occurring rarely at the absorption-period, and is mostly met with in the phthisical form of that inflammation. In primary idiopathic pleuritis it is very rarely to be detected, because the period of its existence has usually passed away before the chest is submitted to examination. In cases of intercurrent pleurisy, where the patient has been under treatment for the primary disease, a better opportunity is afforded of establishing its existence. Another source of difficulty in its detection, even in tuberculous cases, is the shortness of its duration : a single day suffices for its production, development, and termination ; and this series of changes may, as I have, though rarely, observed, be accomplished several times successively in the course of a few days.

350. The ordinary seats of grazing friction are the infra-mammary, infra-axillary, and infra-scapular regions ; I have not yet satisfied myself of its existence, either in the supra-spinous, supra-clavicular, or infra-clavicular regions : probably it is masked in these vicinities by the louder morbid sounds usually present. The sign is not only of clinical but of pathological importance, because it has helped to connect the fugitive chest-pains of phthisis with local and evanescent pleurisy.

351. 2. *The rubbing variety*, a more advanced type of friction, consists of a series of jerking sounds, rarely exceeding three or four in number ; is audible over a tolerable extent of surface, provided the necessary condition of mobility of the lung exist ; of rather considerable duration ; slowly evolved ; attends both inspiration and expiration, and is more frequently than other varieties attended with friction-fremitus. It occurs in acute pleurisy, at the periods of plastic exudation, and of absorption, being more frequently detected at the latter. The mechanism of friction-sound causes a difficulty in conceiving its production, where great liquid effusion is present in the pleura ; and ordinary experience is in accordance with *a priori* considerations—the two conditions are not observed to coexist. Dr. Stokes was, however, the first to mention a case in which, though great and universal dulness of the side existed, friction-phenomena were audible, and even perceptible to the patient in the postero-inferior and lateral portions of the chest : “ they may then,” he infers, “ coexist with extensive

liquid effusion." There is one source of fallacy in such cases: supposing them to have reached the period of absorption, the fluid might have been nearly removed, and yet the condensation of the superficial strata of the lung, combined with an accumulation of plastic exudation-matter, been sufficient to produce extensive and marked dulness. Now, under such circumstances, the production of friction-phenomena would have been inevitable. However, the retention of some portion of the lung's surface in tolerably close proximity to the costal pleura, by means of adhesions, also renders the production of friction-sound possible, although a considerable quantity of fluid be present in the pleura. M. Fournet states that he once ascertained the coexistence of these three conditions; and I presume that some examples I have myself observed of coexistent friction-sound, and general effusion-signs, were thus explicable.* Effusion-signs may be evident in the back, and friction-signs in front; this is common.

352. Laennec described friction-sound as an attendant upon, and one of the most important diagnostic signs of, interlobular emphysema; while he made no mention of its existence in pleurisy. The experience of his followers has reversed the connection which Laennec sought to establish: it is now believed that emphysema of any anatomical form is as incapable of producing friction-signs, as pleurisy is indubitably their common cause. Andral, Louis, Stokes, Fournet, and other writers, agree in denying, either directly, or by inference, that the collision of subpleural sacculi, or of pulmonary septa rendered prominent by infiltration of air, against the opposite pleura, is an observed cause of friction-sound. Such was the opinion which I held upon the point also; and I still believe that we want the anatomical proof of the phenomenon being thus generated. But from some cases I have met with of very advanced emphysema, manifestly attended with a low degree of rubbing-sound at the postero-inferior part of the chest, where subpleural sacculi are very commonly developed, and presenting neither signs nor symptoms indicative of pleurisy, I am induced to think that Laennec's belief respecting the occurrence of friction-signs in some forms of emphysema was not erroneous.† Upon referring to certain cases in my possession of individuals dying with extensive infiltration of air under the pleura, I find the

* Friction sound may exist in the inflamed pericardium with an amount of fluid (sixty ounces) which makes its mechanism difficult of comprehension, Bartlett, U. C. H., *Males*, vol. iv. p. 292.

† I have (Hayes, U. C. H., *Females*, vol. v. p. 25,) distinctly observed them in the mammary region also.

existence of friction-sound during life noted, and certainly not a syllable respecting exudation-matter in the pleura among the details of the post-mortem examination. I can scarcely think that so obvious an appearance as this would have been forgotten, had it existed. These cases, too, are perhaps deserving attention, because collected at a period when I had a preconceived notion against the possibility of friction-sounds being evolved in the manner now referred to. It is true, Dr. Stokes maintains their evolution under the circumstances to be physically impossible. "It is only," he observes, "when the surfaces are rendered dry by an arrest of secretion, or roughened by the effusion of lymph, that their motions produce sounds perceptible to the ear." But this remark, which is perfectly just, if applied to these surfaces when holding to each other their natural relation of simple approximation without mutual pressure, begs the question at issue when applied to pleural laminae, one of which presents elevations on its surface necessarily productive of some slight pressure against the other.

353. *The grating variety* conveys the sensation indicated by its name; and, except in respect of its greater sharpness, is characterised as the last variety. It may occur at the period of absorption, with or without retraction of the chest, and occasionally at that of exudation. It sometimes indicates that the exudation-matter is laid down in the granular form. This variety may also be produced by subpleural miliary granulations, causing superficial prominences.

354. (β) *The creaking species* is suggestive of the noise produced by the creaking of new leather of moderate hardness; in other respects it resembles the rubbing variety, with which it has a tendency to coexist. It commonly indicates dryness, firmness, and toughness on the part of the exudation-matter, and hardly occurs, except in cases lapsing into the chronic form. The capsule of induration-matter, that sometimes caps tuberculised apices, furnishes in rare instances, *by its own motion on itself*, a modification of this sound, most frequently audible in the supra-spinata fossa,—hence the necessity, on the score of mechanism, of making it a species apart.

355. (γ) *Crackling (pleural pseudo-rhonchus)*.—In the winter of 1842 I made the following observation:—In a male adult presenting the most evident signs, both in front and behind, of a cavity at the left apex, an extremely abundant medium-sized rhonchus occurring almost in puffs, and having the liquid bubbling

character in a most marked manner, was day after day during the week previous to death, detected in the entire height of the left side posteriorly. The rhonchus was, however, distinctly more abundant and more liquid, as noted in writing during life, in the upper scapular and upper part of the lower scapular regions, than elsewhere. As the patient was anasarctous to a high degree, the urine albuminous, and as he constantly lay on the left side, the explanation of the rhonchus naturally suggesting itself was, that it depended on œdema of the pulmonary tissue generally, but most marked at the apex, and there of course affecting tissues lying between the cavity and the surface of the lung. At the post-mortem examination, however, I found this explanation was inadmissible; for the thin lamella of tissue between the cavity and the surface was as hard as cartilage, and contained not a particle of serosity; nor was the organ in any part distinctly infiltrated with fluid, being, on the contrary, particularly dry from its excessive induration. But all along the posterior surface of the pulmonary pleura there appeared, in addition to ordinary dense pseudo-membrane, a quantity of fine adventitious areolar tissue, abundantly infiltrated with liquid. Masses of some size were formed from place to place by the accumulation of fluid in the meshes of this cellular tissue, and it was observed by those present, who had not seen the patient during life, that they were much larger at the apex than elsewhere. There was no air either in the cavity of the pleura, or intermixed with the serosity. Now, although it was possible to suggest another explanation, it seemed most reasonable to suppose, under the circumstances, that the rhonchal sound was actually produced in the masses of infiltrated tissue referred to, and therefore outside the lung, and indubitably of air.*

356. Subsequent experience has amply proved the correctness of this explanation, and shown that moist sounds, rhonchoid in properties, are producible whenever adventitious tissue within the pleura is infiltrated with serosity, and the movements of the chest continue free. The sounds occur in two forms, *squashy* and *crackling*. The character of the first is represented by its name, and coupled with the sensation of extremely superficial site, suffices for its diagnosis.† The crackling form, in itself indistin-

* *Phys. Diagnosis of Dis. of Lungs*, p. 245, 1843.

† The precise spot where infiltrated false membrane exists may be pointed out during life by the sound *cr*, cases of fibriliths, U. C. H., *Males*, vol. ii. p. 183; and Donovan, U. C. H., *Males*, vol. ii. p. 202.

guishable from some conditions of loose bubbling rhonchus, may be diagnosticated by the coexistence of friction-sounds, constant or occasional, and by its being unaffected by coughing. Mere moisture in plastic matter within the pleura seems enough to give a rhonchoid character to friction-sound.

357. (8) *Rumbling*.—Instead of being composed of a series of distinct interrupted jerks, friction-sound may be prolonged without cessation from the beginning of inspiration to the end of expiration; for this variety, evidently allied to pleural pseudo-rhonchus, the name of *rumbling* may be chosen.*

358. To return to the *general characters* of friction-sound: The duration of each jerk of friction-sound, as also of the whole series in each act of respiration, depends on the extent of surface in a state to furnish the sound, the freedom of motion, and dilatibility of the lung. The length of time friction-sounds may continue audible in a case of pleurisy, especially during its absorption-period, varies greatly.

359. Although the audible characters of friction-sound are, as mentioned above, somewhat influenced by, they do not bear any constant relationship to, the physical state of the exudation-matter generating that sound. We cannot predicate from the character of friction-sound the state of pleural exudation,—it is even doubtful, that we can affirm, on the evidence of friction-sound, whether this is caused by exudation or by mere dryness and vascularity of surface,—as will be more fully shown with the history of pleurisy.

360. The motion of respiration is, of course, the ordinary *dynamic* cause of the collision of surfaces required for the generation of pleural friction-sound; where movement is seriously obstructed by dense hepatisation, there may be abundant plastic exudation on the surfaces without a particle of friction-sound.† However, as first noticed by Dr. Stokes, the heart's impulse also may, under favouring circumstances, produce intra-pleural rubbing-sound. The rhythm of ordinary pleural friction coincides with the movements of respiration,—that of the variety, generated by cardiac impulse, synchronises with that of the heart's movements; hence a difficulty, considered in connection with Diseases of the Heart, in determining on the pericardial or really pleural origin of such friction.

361. (d) *Adventitious sounds in the mediastina*.—Crepitation,

* Case of Lockett, Clin. Lectures, Lancet, April, 1849, p. 390.

† Shears, U. C. H., Males, vol. xv. p. 57.

inspiratory and expiratory, of variable degrees of dryness, abundance, and size, audible in forced respiration only, or in calm breathing, constant or intermittent, disappearing after a few chest-expansions, or continuing through a long examination, is sometimes to be discovered over the sternum, generally or partially, while it is completely wanting over the contiguous portions of lung. No symptoms of any kind necessarily attend this state.*

362. How is it produced? When the areolar tissue is infiltrated with serosity and air, the production of such sound through the movements of the chest is quite intelligible. I observed the fact in the remarkable case of an Indian juggler, where air was infiltrated into the mediastina, through perforation of the œsophagus and pericardium effected in the attempt to swallow a knife.† But whether the presence of air be absolutely requisite, I do not know as matter of experience. This pseudo-rhœchus derives its clinical interest from the likelihood of its being mistaken (as it has actually been) for the crepitant rhœchus of marginal pneumonia.

363. A rhœchoid sound may be produced in the mediastinum by the heart's impulse against the infiltrated areolar tissue; it is then of cardiac rhythm:‡ or, in the same individual, the mediastinal space may give rise to squashy sound of cardiac and pulmonary rhythm combined.§

364. (c) *Adventitious sounds in the thoracic parietes.*—Various sounds generated in the framework of the thorax and its integuments by the breathing movements, aided or not by pressure of the stethoscope, derive interest from the chance of their being confounded with intra-thoracic sounds,—a chance not unfrequently realised. There is scarcely a form of pulmonary morbid sound that may not be thus simulated.

365. Pseudo-crepitation will occur, if the stethoscope be accidentally placed over hair on the surface,—in a less deceptive form, if the subcutaneous areolar tissue be emphysematous. The crepitus of a fractured rib has been mistaken for the rhœchus of pneumonia.

366. Creaking sounds are sometimes heard about the cartilages, probably from interstitial dryness, as they are by far most

* Scott, U. C. H., Males, July 23, 1850.

† Bancroft, Univ. Coll. Mus., No. 3859.

‡ Lewis, U. C. H., Females, vol. xiv. pp. 73, 111.

§ Hare, U. C. H., Females, vol. x. p. 98; Baker, U. C. H., Males, vol. xvi. p. 150.

common in aged persons; I have known these mistaken for creaking pleural friction-sound.

367. A moist rhonchoid sound, perfectly resembling fine bubbling, is often audible, when the integuments are infiltrated with serum. This anasarcaous sound may disappear totally, when the subjacent fluid has been completely pressed aside by the end of the stethoscope.

368. Pseudo-friction sound is also, though less frequently, producible by anasarca of the chest walls. The imitation may be distinguished from the reality by its being limited to œdematous spots, by its existing in the abdominal walls, as well as the thoracic walls, by its not being perfectly synchronous with the respiration-movements, and by its disappearing after steady pressure with the stethoscope.*

369. A sound, imitative of intra-thoracic friction, may be produced by the movements of the scapula in breathing,—probably when the arcolar tissue between that bone and the chest-wall is unusually dry. When occurring in the upper fossa, it simulates somewhat the clogged-wheel-rhythm [278]. At either fossa the sound is removable by a few brisk movements of the arm.

370. The muscular actions going on in the chest-wall give rise in some persons to a peculiar buzzing rumbling sound; its amount does not appear to be directly as the muscularity of the individual. It is increased by efforts of all kinds,—as for instance, that of maintaining an uncomfortable posture; it is continuous, not rhythmical with respiration; and rather increases, than diminishes, in intensity when the breath is held. It may in some spots be removed by putting the muscles in a state of relaxation; but in the infra-axillary regions, where it is sometimes highly marked, cannot be thus annulled.

371. According to the site of various of the sounds now passed in review, they may, without due care, be taken for evidences of pleurisy, pericarditis, pneumonia, œdema of the lung, or phthisis.

372. (*f*) *Adventitious sounds produced in neighbouring organs.*—Very little care will prevent the rhonchoid noise, caused by swallowing saliva, and by intestinal borborygmi, from being mistaken for intra-pulmonary sounds. In cases of great gaseous distension of the stomach, the bursting of bubbles within that organ may simulate amphoric rhonchus with echo and metallic tinkling:

* Peculiarities all of them observed in the case of J. Morris, U. C. H., Malex, vol. vii. p. 159.

the percussion-sound will at the same time be extensively amphoric (not tympanitic), in the left inferior regions; but there will be no amphoric breathing, and the act of swallowing fluid will be immediately followed by an increase of the rhonchoid sounds.

§ 11.—THE RESONANCE OF THE VOICE.

I.—IN HEALTH.

373. The particular rules for performing auscultation of the voice are not numerous. The most essential point is, that its pitch, intensity, and tone be the same, while different points of the chest are examined. Now this uniformity can only be insured by causing the patient to repeat monotonously the same word or syllable: even slight inflection of tone may modify the resonance; and variation in the class of consonants pronounced will have even more certainly the same effect. If the patient be a singer, he should be directed to intone various notes.

374. Generally speaking, the patient's utterance should be loud, while the vocal resonance is examined; but in the auscultation of the voice over caverns, the most decisive information is sometimes obtained from the whisper, beyond which the patient is, in the advanced stages of laryngo-pulmonary disease, frequently unable to raise his tone.

375. The stethoscope should be laid firmly upon the surface, and the ear similarly applied to the instrument, but without any degree of forcible pressure; if either be too lightly applied, a tremulous character may be given to the resonance; if too forcibly, the distinctness of this is diminished. It is scarcely necessary to add, that the instrument should be used in precisely the same manner, and in precisely corresponding spots upon both sides of the thorax. The condition known as exaggerated resonance is perhaps more accurately appreciable by means of immediate than mediate auscultation; all other unnatural states of vocal resonance are more satisfactorily ascertained with the stethoscope.

376. In examining certain regions, extra care must be used both in the manner of applying the instrument and in drawing inferences from the results obtained; the chief of these regions are the post-clavicular, the upper sternal, and the inter-scapular. The vicinity of the trachea or large bronchi is, without such care, liable to mislead the observer, on account of the naturally greater resonance to which that vicinity gives rise. When the post clavi-

cular space is examined, especially its inner part, the stethoscope should be held as nearly as possible parallel to the trachea.

377. *Characters of natural resonance.*—If the stethoscope be applied over the larynx or trachea of a healthy individual while speaking, the voice is transmitted, imperfectly articulated, through the instrument to the ear, with a degree of force, loudness, and concentration so great, that the experiment may be productive of actual pain to the observer, especially if the voice examined be grave and powerful. The same transmission of the voice occurs at the lateral parts of the neck, and even over the spinous processes of the vertebrae behind, but with less intensity than on the middle line in front. The resonance of the voice heard in these situations is called *natural laryngophony* and *tracheophony*. At the upper part of the sternum, on the middle line, the vocal resonance is considerably weaker; towards the edges of the same part of that bone a still further diminution is perceptible, and the resonance is here reduced to the state called *natural bronchophony*. The sound is now more diffused, its articulation very imperfect, its quality like that of the voice heard through a speaking-trumpet; it also appears to be, as it actually is, produced at a greater distance, and no longer seems to strike directly against the ear. This species of resonance is also observable posteriorly on the middle line over the division of the trachea, and on either side of that division between the spines of the scapulae. Over the parietes of the chest, with the exception of the parts just referred to, the natural resonance of the voice amounts to no more than an obscure buzzing, unattended with any approach to articulation, and appearing to reach the ear from, rather than to originate at, a certain depth within the chest, and from an indeterminate extent of surface: in many persons even this obscure buzzing is wholly deficient.

378. The intensity and quality of this natural resonance are modified by certain circumstances altogether independent of disease. Thus, the natural resonance is *ceteris paribus* marked in proportion to the graveness of the voice. This statement is only true of intensity, however; there is no greater tendency to concentration or articulation of the sound when the voice is grave than when it is shrill: Secondly, vocal resonance is, as a corollary from the last proposition, more marked in males and in adults than in females and in children; it is also more marked in aged persons than in adults, doubtless on account of the wasting of the pulmonary parenchyma, and the thickening and hardening of the bronchi in old age: Thirdly, the quality of the resonance varies

with the quality of the speaking voice; thus in people of advanced years it is very commonly tremulous and blenting: Fourthly, the resonance is more strongly developed, the larger the chest, and the less loaded its walls with fat and muscle: Fifthly, it is stronger in front than behind, with the exception of the interscapular region; and at the upper than the lower parts of the thorax: Sixthly, as first stated by Dr. Stokes, its intensity is greater on the right side generally than the left,—a fact chiefly significant, though by no means valueless elsewhere, under the clavicles and in the interscapular regions: there is no resonance over the superficial cardiac region, nor over the hepatic surface below the sixth rib: Seventhly, the intensity of vocal resonance, as of the respiratory sounds, varies much in persons apparently presenting the same physical conditions for its development;—hence the danger of drawing any inference directly from the state of vocal resonance in a given portion of the chest; it is only by the application of the principle of comparison of the two sides that any safe result can be obtained, due allowance also being made for their natural differences.

379. Vocal resonance may be well marked in a spot where vocal fremitus is feeble or wholly deficient [78, 404*].

II.—IN DISEASE.

400. The signs derived from modified vocal resonance are uncertain in character and obscure in theory, and, though occasionally not devoid of clinical signification, hold, as a rule, a very low place among physical aids to diagnosis.

401. The natural vocal resonance may be diminished or increased in intensity, without or with alteration in quality. Its perversions may be arranged thus:

Diminished intensity	{	Weak	{	Simple. Pectiloquous—amphoric. Aggophonic.
		Suppressed.		
		Exaggerated		
Increased intensity	{	Bronchophony		

402. Diminution of resonance varies between weakness and suppression. *Weak resonance*, as the title implies, signifies a state in which the vocal resonance is distinctly less marked than natural; commonly spoken of as rare, it is really of frequent occurrence. Thus in the dilatation-period of liquid and aeriform effusion into the pleura, in cases of obstructed main bronchus, even in solidifi-

cation of the lung, and over excavations, the corresponding resonance may be temporarily weaker than natural.

403. *Suppressed resonance* means that rare condition in which all transmission of the voice to parts of the surface, where naturally perceptible, has ceased; no audible sound being conveyed there. Impairment of vocal resonance exists in emphysema; in pneumo-thorax, simple or fistulous, actual suppression may occur. But neither of these conditions is constant: in emphysema the resonance may be extra-powerful. Simple pneumo-thorax is so rare, that we have little opportunity of substantiating its signs, and special peculiarities occur in the fistulous variety. During the dilatation-period of pleuritic effusion the resonance may be weakened even to suppression. The resonance may temporarily be null over an excavation [412].

404. Increased resonance presents itself in the forms of *exaggerated resonance* and *bronchophony*, which are little more than forms of each other. The intensity of sound in the former undergoes simple increase; in the latter there is, besides, just as in the natural resonance over the main bronchi, a greater concentration of sound: the former may be considered a *diffused* bronchophony; the latter a *concentrated* resonance of exaggerated force. In bronchophony the sound is also ringing, and more distinct; unattended with appreciable articulation of the words spoken; and occasionally producing a quivering sensation in the ear of the observer. Both are usually constant phenomena, so long as they exist; that is, produced every time the patient speaks. The area of bronchophony may, or may not be, sharply defined; in other words, the transition from the most distinct bronchophony to the natural resonance may be sudden; or, as is more common, a gradual diminution of the phenomenon is traceable. In quality it may be metallic, sniffling, or partake, chiefly in aged persons, of the tremulous and bleating tone especially characterising ægophony.

404°. As in the case of natural resonance, there is no uniform ratio of strength of morbid bronchophony and of vocal vibration; the audible impression may be powerful, while the tactile is null [74]: of the converse condition I have no experience,—at least, that I can remember. The inequality seems paradoxical enough, but not more strange than the sudden cessation of fremitus in running the gamut, when a certain note is reached, no matter how loudly it be sounded [73, note], while with all tones lower in the scale even though feebly uttered, the vibration may be strong.

405. The physical conditions in which simple bronchophony is

clinically observable are:—1. Increased density of the pulmonary tissue either surrounding pervious bronchi, or forming a medium of communication between pervious bronchi and the spot of the thoracic surface examined, whether that increase of density be caused by solid, semi-solid, or even liquid infiltration of the parenchyma. 2. Increased density of texture, produced by extraneous pressure. 3. Presence of any solid extra-pulmonary formation in such a situation as to form a connecting link between the surface examined and a bronchus of some width. 4. Increased width and hypertrophy of the substance of the bronchial tubes. 5. Diminished density of the lung, as in the rarefaction of vesicular emphysema. 6. Excavation of the lung. The diseases referrible to the first head are the common causes of bronchophony, but any hypothesis in explanation of the phenomenon must also apply to the other and comparatively rare causes.

406. Thus in its maximum degree, and marked by the metallic and sniffling quality, bronchophony coexists with tubular blowing respiration, in the parts corresponding to hepatised lung. In the non-metallic form it is heard in tuberculous and plastic consolidations, in pulmonary apoplexy, slightly in pulmonary oedema. It exists in dilatation of the bronchi; but the enlarged calibre of the tubes is not habitually the sole condition of its presence; coexisting thickening, and hardening of their walls, and condensation, attended with chronic induration, of more or less pulmonary substance around (as in established cirrhosis of the lung), contribute materially to its production: still, increased width may be the sole appreciable cause of the sign. Bronchophony cannot be regarded as an ordinary sign of pleurisy with effusion. At the stage of effusion with general dilatation of the chest, when a broad mass of fluid intervenes between the lung and parietes, all vocal resonance habitually ceases: but when the effusion is moderate, bronchophony may commonly be detected in the immediate vicinity of the larger bronchi between the scapulæ.* So, too, if there be induration of pulmonary substance, superadded to the mere condensation from pressure, bronchophony may be sometimes very manifest posteriorly and laterally: for example, where slight hepatisation coexists with effusion. Bronchophony may often be heard in the upper front regions, when the effusion is sufficient to condense a

* An amount of effusion sufficient to push the heart to the other side, and annul tubular resonance under the larynx, may be attended with strong bronchophony about the inferior angle of the scapula. *c.p. Crowhurst, U. C. H., Males, vol. ix, p. 142.*

considerable portion of the lung inferiorly. Again, it is affirmed by M. Reynaud that in many cases of pleuritic effusion, where in the sitting posture resonance has been ægophonic, this may be converted into bronchophonic by making the patient lie on the abdomen—the fluid being thus thrown forwards, and the lung-substance brought well up to the posterior chest-wall.* Bronchophony is common also at the period of absorption and retraction of the chest-walls; and, from the existence of partial pleural agglutinations or adhesions, bronchophony is sometimes locally audible throughout the entire course of effusion. Compressed texture, whatever be the cause of compression, may give bronchophonic resonance, if of any notable bulk. The connection of bronchophony with excavations will be by and by considered.

407. There are two conditions of vocal resonance, described by Laennec under the names of pectoriloquy and ægophony, the nature and significance of which are yet *sub judice*.

408. The essential character of pectoriloquy, is according to its discoverer, complete transmission of the voice through the stethoscope,—that is, a sensation as if the words uttered passed directly into the ear of the observer from the spot beneath. This condition of resonance he believed to be peculiar to excavations in the substance of the lung, and, besides, an invariable attendant on them, except when extraneous circumstances interfered with its production or propagation. As, however, he repeatedly met with excavations which furnished during life only a more or less faint imitation of such resonance, he found himself constrained to admit “imperfect and doubtful” varieties of pectoriloquy—obviously nothing more than simple bronchophony. But he does not seem

* Skoda declares he has frequently repeated Reynaud's experiments, but never obtained the like result. He indirectly even questions the possibility of the lung being brought nearer the posterior surface by the above change of position, because the compressed or hepatized lung is heavier than pleuritic fluid, and consequently the change would have the precisely contrary effect on the relative positions of the organ and surrounding liquid. I disagree completely, as matter of actual experience, with Skoda in this form of a *pueræ* objection to Reynaud. I have repeatedly found, and shown to a clinical class, that in cases of pleuritic effusion, friction-sound may be made audible in spots where none was to be heard in the sitting posture, by causing the patient to lie on the face for a short while. How is this to be explained but by the lung being brought, through the changed attitude, into apposition with the posterior chest wall? Relative gravity is evidently not the sole element in the matter. Besides, I have occasionally found by experiment a positive change in the ægophonic quality of the resonance producible, in the manner described by Reynaud (e. g. Ward, *U. C. M., Females*, vol. vi. p. 65, proved *post mortem*). How can Skoda say he has repeatedly performed Reynaud's experiments, when almost in the same breath he affirms “patients having non-aerated fluid effusion in sufficient quantity to cause increased vocal resonance, either could not hear at all, or hear only for a few moments the change of posture required for Reynaud's experiment?” *Zweite Auflage*, p. 68.

to have been aware that most perfect pectoriloquy, as defined by himself, may occur where a solid mass, of medium size, is interposed between a main bronchus and the surface, and hence, under conditions, the most strongly opposed to those of excavation. Facts of the first class show that cavities may exist without pectoriloquy; facts of the second prove that pectoriloquy may exist without them: hence, in his notions of the diagnostic force of the sign, Laennec was indubitably wrong. But neither one nor the other class of facts disproves the reality of the specific propagation of articulate sounds to the ear, as described by Laennec.

409. In conformity, then, with the principle of recognising the individuality of every sound having special acoustic properties, I retain pectoriloquy,—merely, however, as a variety of simple bronchophony, under the title of *pectoriloquous*. It closely resembles the resonance heard over the larynx, and may exceed this in intensity; like the laryngeal voice, it appears to pass directly through the stethoscope into the observer's ear, and may throw the concha, and even the neighbouring part of the skull, into more or less strong vibration. Limited generally to a small and accurately defined space, it may have a hollow and ringing character or not. Though as a general fact, loud, this is a wholly unessential property of pectoriloquous bronchophony, depending in great measure on the power of the laryngeal voice: the hollow and ringing characters, the insulation of the phenomenon, and its transmission in an articulated form through the stethoscope, may be distinctly marked, even when the speaking voice is almost destroyed. When the physical conditions of its production exist in a patient thus reduced almost to a state of aphonia, it becomes peculiarly characteristic—low muffled whispers pass directly into the ear, articulated sometimes with as much, if not more, precision than the laryngeal voice (*whispering pectoriloquy*, or *whispering chest-speech*). So perfect is the chest-reproduction of the laryngeal sounds in some cases, that I have occasionally been able, the stethoscope being placed *below the scapula*, and the distal ear carefully closed, to say what were the words uttered by the patient, when these were monosyllabic and simple [782]. In instances of this kind there is no tactile fremitus on the surface, nor is any thrill communicated to the concha of the listener,—proof unmis-takenable that such thrill is not an essential element of pectorilo-quous bronchophony.

Loud pectoriloquy may in each syllable be followed by a sort of

whispering or buzzing echo,—sometimes also be preceded by an inarticulate whisper.

410. Bronchophony becomes pectoriloquous in certain conditions of solidification and of excavation in the lungs, and in cases where solid masses lie between the bronchi and the parietes: the most marked pectoriloquy of the *loud* form I have almost ever heard, existed near the right sterno-clavicular angle, over a fibrous nodule in the pleura, the lung being healthy and simply slightly condensed at the spot by pressure.

411. Here, then, is a sign common to two conditions, which are, to all seeming, in physical constitution the precise reverse of each other; do there exist any means of surely determining to which of the two the sign may be due in any individual case? Where the quality of the resonance is markedly hollow and ringing, and where it exists in the *whispering* form, I long believed that it strongly indicated a cavity; but, as I have found whispered pectoriloquy over even simple acute hepatitis,* as well as in the retraction-period of pleurisy [304], it is plain that particular character fails to distinguish the two modes of causation. And it is rather through the co-existences of pectoriloquy than through its own attributes, its mechanism may be made matter, sometimes of certainty, sometimes merely of surmise.

412. Whatever be the nature of the excavation, gangrenous, purulent, apoplectic, cancerous, or tuberculous, globular dilatation of a bronchus included, pectoriloquy *may* be perceptible. But it may not occur at all; or, if occurring, may be transitory or intermittent. The conditions of an excavation most conducive to such resonance are,—moderate size; smoothness and density of its internal surface, hence absence of bands either traversing its area or coasting its walls; emptiness; superficial position, and especially adhesion of its periphery to the parietes of the chest; thinness and hardness of that portion of its walls next the surface; and free communication with the bronchi. Where, on the contrary, a cavity is possessed of flaccid irregular walls, is more or less nearly filled with fluid, and deeply seated, with healthy lung interposed between it and the surface, the resonance will be wholly deficient in pectoriloquous character, and may be strongly or faintly bronchophonic, or *absolutely null*. Moderate size is of im-

* McLane, U. C. H., *Malea*, vol. xii. p. 181, Oct. 1855. Bronchophony is actually sometimes better perceived with the whispered than the ordinary voice. Wright, U. C. H., *Females*, vol. xv. p. 14.

portance; small cavities, unless under special circumstances of seat, are rarely pectoriloquous; and very large dimensions are equally opposed to such resonance.* Very small diameter of the communicating bronchi impairs the distinctness of the phenomenon; and want of communication with the bronchi, also, will prevent its development, persistently or temporarily, according as the obstruction is itself permanent or dependent upon passing circumstances, such as accumulation of sputa in their interior. On the other hand, as observed by Laennec, where the number of fistulous openings by which a large excavation communicates with the bronchi increases, pectoriloquy becomes indistinct or ceases altogether; and if a communication be set up between a cavity and the pleura, or if the contents of the former escape into the subcutaneous areolar membrane, the phenomenon of pectoriloquy disappears. It follows very clearly from these facts, that pectoriloquous bronchophony must be frequently wanting in cases of caverns in the lungs, and that the other signs of destruction of pulmonary substance are much more trustworthy.

413. *Amphoric bronchophony*.—When the vocal resonance has a metallic character, is not transmitted forcibly through the stethoscope, is not articulate, but conveys the impression of its being produced in a hollow space of large size, it is called amphoric, from the similarity of the phenomenon to that produced by speaking into an empty pitcher.

414. *Ægophony* (*alyós* gen. of *alē*, a goat, and *φωνή*, voice), the name given by Laennec to a special resonance, distinguished by its tremulous, nasal, and cracked character, suggestive of the bleating of a goat, is another variety of bronchophony. When most strongly marked it is distinctly ringing, jarring, and muffled; is *quasi*-synchronous with the articulation of each word, or rather follows this immediately, like a feeble, sometimes whispered, echo of higher pitch than itself; conveys the idea of somewhat distant origin; does not appear to traverse the stethoscope, but rather to flutter tremulously about the applied end; is commonly persistent, but of short duration; audible over a very limited surface, and occasionally, but by no means always, producible in fresh spots by varying the posture of the patient. Certain modifications of pure regurgitation have been happily compared by Laennec to the voice passing through a metallic tube or cleft reed,—that of a

* Thus (Green, U. C. H., Females, vol. v. p. 148), over an enormous tuberculous cavity furnishing perfect amphoric respiration with metallic echo, there was occasionally complete absence of vocal resonance of any kind.

person speaking with a counter between his lips and teeth,—and to the nasal twang of the exhibitors of Punch.

415. Rarely lasting more than from two to five days, Laennec has known egophony continue in cases of chronic pleuritic effusion for several months. It does not accompany all notes of the voice, nor all words, even though pronounced with the same pitch: this peculiarity does not depend on the loudness of the laryngeal voice.

416. Pure egophony is observed in certain cases, where a stratum of fluid contained in the pleura compresses the lung. The precise thickness of the layer of fluid most favourable to its production cannot be either laid down as matter of observation, or satisfactorily calculated. Laennec states that he has discovered this sign when there were not more than three or four ounces of fluid in the chest; I have certainly no experience of its occurrence with an amount even nearly so small. It appears in fullest force during the period of gravitation, before any detrusion of the parietes has occurred, and consequently, while the fluid is still moderate in quantity, and its upper part spread thinly over the pulmonary surface. With the increase of effusion it disappears altogether, to return again when absorption has reduced the liquid to a thin layer. So, too, in cases of paracentesis for empyema, egophony sometimes appears after a certain portion of the fluid has escaped. On the other hand, exceptional instances occur, not always explicable by the existence of adhesions, in which egophony remains in spite of very abundant accumulation. I have seen such cases,* and such a one has been published by Andral (*Clin. Med.*, t. ii., Obs. xxi.), where displacement of the diaphragm and heart gave evidence of the abundance of the fluid.

417. Supposing the patient to be examined in the sitting posture, the seat of the phenomenon will be found to be the neighbourhood of the inferior angle of either scapula, and a few inches on either side in a line with that angle; in very rare cases extending almost to the nipple in front. This limitation of seat is important as diagnostic of true egophony. The shrill egophonic quality of resonance, traceable to a naturally sharp and tremulous character of the voice would be thus distinguished from resonance actually caused by the presence of fluid in the pleura, inasmuch as the former would exist in the highest degree wherever the dulness under percussion was most marked; that is,

* e.g. Ward, U. C. H., *Females*, vol. xi. p. 63.

commonly at the base of the lung. Now ægophony does not exist where the dulness is greatest: far from this: such a quantity of fluid as is capable of causing very notable dulness (rise of pitch with loss of tone) will almost inevitably, as just seen, cause the disappearance of ægophony, if it have previously existed. Exceptional cases are met with, however, in which the seat of true ægophony is more extensive. Laennec sometimes observed it over the entire affected side at the commencement of the disease. In two such cases he "ascertained, by examination after death, that this peculiarity depended upon the retention of the lung in partial apposition with the chest by means of pretty numerous adhesions, so that the lung became invested by a thin layer of fluid over its whole surface. In cases of this kind, the sign in question is observable during the whole period of the disease." Whether ægophony is produced precisely on the level of the upper border of the pleural fluid, or at a variable elevation of that fluid, where it is of a certain thickness, is a very difficult point to decide; but the conditions of the respiratory sounds and of the percussion-note, appear, as a rule, to support the latter, the less commonly received, view.

418. Moveableness of ægophony [406] is essentially a character of short duration: the displacement of the fluid either ceases to be possible from the interference of plastic exudation, or the quantity of fluid increases to such a degree as to exclude altogether the conditions of its development.

419. Inflammatory and dropsical accumulations of fluid in the pleura are the states to which true ægophony is almost peculiar,—its existence in cases of hydropericardium is altogether exceptional. In cases of pleuro-pneumonia, when fluid exists to the necessary amount in the pleura, the resonance of hepatisation becomes modified very usually by an ægophonoid twang: but it is extremely rare to observe marked ægophony in these cases. It is true that, while Laennec was still alive, the diagnostic significance of ægophony was impeached by its alleged detection in some instances of simple hepatisation; but the statement (though confirmed of late years by Skoda) appears to me to require corroboration. True, the bronchophony of hepatisation is often swiffling and high-pitched, but it is not tremulous, and I have never yet detected vocal resonance simulating ægophony, as an attendant on simple inflammatory induration of the lung, unless the ordinary voice of the patient was of shrill tremulous character. Hence this exceptional species of resonance is most frequently

encountered in persons, more especially women, of advanced age. I have been gratified by finding that M. Grisolle's experience (*Pneumonie*, p. 242) has led him to a very similar conclusion. The bronchophony of hepatisation may occasionally be given a shrill nasal ægophonoid character by making the patient speak with the nostrils closed.

THEORY OF VOCAL RESONANCE.

420. The theory of vocal resonance, in itself of little direct clinical importance, has acquired great interest from the part it has been ingeniously made to play by Skoda in his attempt to remodel the doctrines of auscultation at large,—more especially as whatever principle be accepted in its explanation may, *mutatis mutandis*, be applied to the varieties of bronchial breathing.

421. (a) Before we proceed to the discussion of this subject a few preliminary observations are requisite. In the case of natural respiration, the sound which is heard at any portion of the chest's surface is, it is taken for granted, produced in the lung-substance nearest the ear. The assumption is obviously, however, sometimes incorrect. At the sterno-clavicular angles, for instance, the bronchial breathing actually heard is not produced in the parenchyma overlaying the bronchi, but generated in those tubes themselves and conveyed to the surface,—drowning, as it travels, by its greater intensity and harshness, the breathing-sounds of the intervening and adjacent lung-substance. Again, respiration can be distinctly heard in the mass of people over the liver to a greater or less extent below the margin of the lung. Hence there are spots where, in the natural state of the breathing apparatus, we hear not what is passing immediately beneath, but at a greater or less distance. A striking illustration of another kind presents itself in the case of the voice, produced, as it is, in the larynx, yet audible, with various intensities, in various regions of the thorax.

Now, in these cases the only principle in action is that of *conduction, vertical or horizontal* [221].

(b) In disease, this phenomenon of conduction becomes most important, as it furnishes, according to common belief, the main, if not the sole clue to the explanation of a variety of morbid speaking and breathing-sounds. Not only the lung-substance, but the parietes themselves conduct: thus the existence of brouchophony and bronchial breathing over the vertebral column

in cases of hepatisation is well known,—the bony structures here play the part of conducting media.

This premised, let us consider the mechanism of bronchophony.

422. (A) *Mechanism of Bronchophony*. — Laennec regarded bronchophony as an essential dependence on increased density of the pulmonary texture, and supposed that it was simply produced by the greater facility with which comparatively dense and comparatively homogeneous tissue—homogeneous from the exclusion of air—conducted the laryngeal vibrations.

This explanation is inadequate to meet all the circumstances of the case. In the first place, bronchophony may exist, and this to an intense amount, over lung rarefied to such a degree as to give actually almost tympanitic resonance under percussion. Of this fact, not generally known, or, at least, taught, I have observed a certain number of examples, where *post mortem* examination left no doubt of the absence of any textural change in the lung except emphysema. In the second place, as was, I believe, first mentioned in print by Skoda, the voice resounds sometimes with greater intensity over the chest than over the larynx itself. In the third place, the pitch of the bronchophonic, differs sometimes distinctly from that of the laryngeal voice. These facts, without disproving the partial correctness of Laennec's theory, show at least that it requires an addition of some kind to make it include all the varieties of the phenomenon.

423. Skoda, holding the general doctrine that the "varying conducting power of the healthy and diseased lung-substance cannot be taken as a basis of explanation of the phenomena of auscultation,"* specially opposes Laennec's views of the mechanism of bronchophony on the following grounds:—

424. (a) Bronchophony may in the course of a few minutes appear and disappear over hepatised lung, the other physical signs, especially the percussion-sound, having undergone no change. (b) When vocal resonance thus suddenly disappears, it may as suddenly be restored by making the patient cough or breathe deeply, so as to free the bronchi from fluid in the part of the organ ausculted. (c) In cases of pleuritic effusion, the resonance grows weaker and weaker in proportion as the fluid increases; now as the lung grows more and more solid, the greater the quantity of pleural fluid compressing it, the reverse ought to be observed, were Laennec's doctrine of solidification and

* *Zweite Auflage*, p. 36. In the fourth edition (p. 37) this negation is limited to the "strength and purity of the voice."

improved conducting capability well founded. (*d*) If a healthy and a hepatised lung be removed from the body, and if, while one person speaks through a stethoscope placed in contact with the surface of each organ successively, a second listens through another stethoscope placed at an opposite point of that surface, the listener will find that more intense resonance reaches the ear through the healthy than the diseased lung. (*e*) It is an error to suppose sounds are better conducted by solid bodies than by air; if it were so, we should use a solid, not a hollow, stethoscope.

425. What is the force of these objections? Let us examine them *seriatim*. (*a* and *b*) Since I first became acquainted with Skoda's statement concerning the appearance and disappearance of bronchophony in hepatisation, I have repeatedly endeavoured to produce artificially the change he describes. Now, as a rule, the experiment has wholly failed.* In some rare instances a very slight passing change in the force of resonance may, it is true, be perceived,—the question is, what is its cause? Skoda, assuming that the alleged temporary disappearance of bronchophony over hepatised tissue depends on passing obstruction of the tubes with fluid secretion, conceives he has effectually undermined the received doctrine of increased conducting power in hepatisation; for "were such increase of power real, it would be a matter of indifference, whether air or fluid were contained in the bronchial tubes." But is this the fact? Is it true that, on the doctrine of increased conducting power, it makes no difference whether one portion of the series of conducting media consist of fluid or air? Obviously the *onus* of proving the fact, if it be a fact, rests with Skoda: meanwhile, we are justified in believing, that such partial variation in the composition of the conducting materials does exercise a certain influence on the general result; an influence quite capable of explaining the very slight variations in the intensity of bronchophony, that have fallen under my notice. Again: let us suppose a case of hepatisation of a tolerably thick stratum of the posterior part of a lung: bronchophony is heard, in such a case, at the posterior, not at the anterior, surface of the chest. Now, as, according to Skoda himself, reinforcement of voice, would, under the circumstances, take place about the central tubes, how comes it, if his doctrine of the superiority of healthy over solidified tissue, as a conducting material, be

* *i. g.*, Shay, U. C. H., Females, vol. ix. p. 144 (Pleuro-pneumonia) "Several coughs, which produce a good deal of loose rhonchus, do not in any way affect the characters of the bronchophony."

constantly correct, that bronchophony is not heard in front over healthy texture, instead of being, as it is, audible in the back, over the hepatised parts? This seems to me an objection fatal to the doctrine. (c) The argument derived from the phenomena of pleuritic effusion seems feeble, and, indeed, unsound. The interposition of a mass of fluid between the condensed lung and the surface alters the terms of the problem completely. It has been shown by Colladon and Sturm, that sonorous rays which reach the surface of water at a very acute angle do not pass into the air, but undergo reflection in the interior of the liquid. Now the angle at which the sonorous vibrations reach the fluid from the bronchi, and ultimately reach the outer surface of the pleural fluid, may very possibly often prove of the degree of acuteness fitted to prevent their passage into the air. At all events Skoda, by ignoring the new influences likely to be exercised by the fluid, renders his argument valueless. (d) The results I have obtained from some experiments on the conducting powers of hepatised tissue, do not agree with those announced by Skoda. First: It is, I admit, quite true, that tissue, called hepatised, may conduct the voice no better, or even less forcibly, than a similar thickness of healthy parenchyma; but it is equally true that this is not a constant result. I have occasionally found hepatised lungs, taken from the body, conduct the sound with extreme intensity. And these varying results may be obtained from a pair of lungs, which the mere eye would judge to be in the same state physically, in regard of their shares of air, fluid, and semi-plastic substance: but it is evident, from the variations in result, that *acoustically*, they are in *different* physical states; and that, therefore, such experiments as Skoda's are not to be trusted to. Specimens of parenchyma, apparently identical, are in reality widely different. There can, for example, be little doubt, that varying homogeneousness plays a more important part than any observable so-called solidification in regulating the conductive power of the lung. In the varying homogeneousness of different specimens may, in truth, lie the key to the difficulty—though, unhappily, it is a key which cannot clinically be utilized. Secondly: If, while one person speaks into a stethoscope with its narrow end introduced into the trachea, a second listens over a part of the chest where hepatised lung lies beneath, and where intense snuffling bronchophony existed during life, the listener will often be surprised at the singular and total absence of sound. Skoda, admitting this fact, attempts to evade its force by supposing the

vibrations to be interfered with by fluid in the bronchi. To this I would reply, that I have satisfied myself of the total absence of such *post-mortem* resonance over pneumonic solidification, in a case where the bronchi, to the third and fourth divisions, were peculiarly free from fluid, and scarcely any spumous liquid infiltrated the parenchyma—which very same parenchyma, removed from the body, conducted the voice from one stethoscope through another with striking intensity. If we consider the main difference in the physical conditions of the parts, when an individual himself speaks, or when another speaks into the trachea after his death, an obvious explanation of the experimental failures to imitate the bronchophony of life suggests itself. In the dead body, in truth, the laryngeal, tracheal, and bronchial walls take no share in the production or conduction of the sound, which is propagated by their contained air alone; whereas in life the walls of those tubes obviously conduct their sonorous vibrations. Besides, hepatised and healthy lungs are not strictly comparable in and out of the body in regard to this matter: *within the body* the contact of a hepatised lung with the chest-wall is more perfect than of a healthy one; and, admitting that the former is a worse conductor in regard of the condition of its substance, it may be a much better one through the closeness of its union, especially if adhesive, with the parietes. Here is a point which has been totally overlooked by the Viennese physician and his followers. (e) The illustration of the habitual preference of the hollow over the solid stethoscope falls pointless,—because as much importance is to be attached to homogeneousness as to density.

426. I conceive then, that, whether Laennec's doctrine be true or false, the arguments just reviewed fail to prove it unsound. Skoda himself naturally thinks otherwise; and, excluding the walls of the trachea and bronchi from all share in the *conduction* of the sonorous vibrations of the *chordæ vocales** (an office assigned by him to the contained air of those tubes alone), maintains that bronchophony is really produced by "consonance" of the air in the bronchial tubes with the laryngeal voice.

427. The hypothesis of "consonance" does not appear to me satisfactory; and it unquestionably fails to meet all the circumstances of the case. The reasons on which I ground this opinion

* Auscultation; Vierte Auflage, pp. 36, 40, and 68. He of course, admits, that the bronchial walls, in the spot where "consonance" takes place, intensify the consonating tones of the air within them by their own vibration; but this is a very different thing from professing those walls take part in the production of bronchophony by conducting the laryngeal voice.

are as follows :—(a) Air in any enclosed space does not consonate with every sound produced at its orifice, but only with the fundamental note of that space, and with certain others having a fixed harmonic relationship to that fundamental note,—with certain of its *concord*s, in short. This is easily ascertained, in a rough way, by running the gamut with the voice at the mouth of an empty water-bottle; one note only of the octave is at all markedly reinforced by consonance within the cavity,—one or two others (according to the distance from the orifice at which the vocal sound is emitted, and the depth of the mass of air within the bottle), very slightly increased in loudness. Now, on the contrary, when bronchophony exists, it is audible with *successive notes* of the octave, standing in no harmonical relationship to each other,—absolute *discord*s, in short. These successive notes are most loudly bronchophonic at the lowest part of each register (whether bass, tenor, or soprano); but the force of bronchophony gradually decreases, not at all harmonic intervals, but on *each successive note from below upwards*, until the resonance disappears altogether; and obviously the greater force of bronchophony with grave tones, as contra-distinguished to acute ones, has nothing to do with the principle of “consonance,”—for consonance, where its conditions are fulfilled, will occur with notes of the latter, as well as of the former class. (b) Bodies consonate only in unison, or in certain fixed harmony, with the original sound which throws them into vibration.* Now the pitch of the bronchophonic voice varies irregularly from that of the laryngeal with which it co-exists. This difference of pitch is especially to be caught in cases of hepatisation, and is sometimes very striking in amount; the corresponding notes heard in the larynx and on the surface of the chest are then, very perceptibly, *discord*s. (c) Skoda's exclusion of the tracheal and bronchial walls from participation in the conduction of the laryngeal voice is at variance both with theory and experiment, and cannot for a moment be acceded to. (d) In cases where the bronchophonic voice is very positively and notably louder than the laryngeal, it is difficult to believe, from the mere fact of the intensity of the sound, that the phenomenon can be due to consonance. For a consonating sound, as a rule, is vastly more feeble than the primitive tone eliciting it: and the nicest adjustment of the quantity of air in the consonating body,

* The unison-note alone is distinct to ordinary ears: the consonating harmonics are so faint as to require a most highly-trained, as well as originally perfectly endowed, ear for their detection.

presuming this to be hollow, is required, in order to produce any serious increase in the amount of loudness. Let it, however, be granted, *argumenti gratia*, that chance may sometimes cause the column of air between the larynx and the seat of bronchophony to be of the appropriate length to produce a marked increase of sound,—the doctrine of Skoda gains nothing by the concession. For, be it remembered, Skoda rejects conduction as an element of bronchophony; bronchophonic voice is, in his apprehension, consonating voice alone; consonating voice is, then, under the above circumstances, by admission, louder than the original voice. Now, here is an idea irreconcilable with observation; for it does not appear that (provided the original and consonating sounds be produced by bodies of the same class, as vibrating strings, hollow boxes, solid plates, &c.) the consonating sound is ever louder than the original tone.* (c) If the excess of loudness of the bronchophonic over the laryngeal voice were from consonance, *vocal fremitus* (inasmuch as the walls of the consonating tubes must vibrate in the direct ratio of the vibration of their contained air) ought to rise and fall exactly as *vocal resonance*. Now, as is notorious, these two phenomena do not invariably maintain any direct relationship to each other; one may gain, while the other loses, in intensity.

428. These objections appear to me conclusive against the pure doctrine of "consonance," while they show that, if consonance plays any part in the production of bronchophony, it must be a subsidiary, rare, and accidental one. And even this concession is rather made on the ground, that the occurrence of consonance within the chest is, *a priori*, possible, than in deference to the arguments actually adduced in its favour.

429. From the discussion into which I have now entered, it would follow that the mechanism of bronchophony is probably complex, and certainly not, as the attempt is commonly made to prove it, invariably one and the same.

430. There are four points which appear especially worthy of consideration: the conduction of laryngeal voice; its possible increase of intensity, within the chest; the distance at which that

* The case may be very different where vibrations are communicated from a body of one physical constitution to a consonating body of another class. Thus, where a tube takes up the vibrations of a solid disc, the consonating note of the tube may (by managing carefully the length of the vibrating column of air in the interior) be made immeasurably more powerful than the original tone; the quality of such notes is exquisitely pure and full, and long ago Savart suggested the construction of a musical instrument on this principle which, it seemed probable, would exceed in melody and power any of those in use. Civilised nations have not profited by the philosopher's suggestion; yet the savages of some of the Pacific islands, curiously enough, have hit upon rude contrivances efficiently illustrating the principle.

increase of intensity, if real, is effected from the part of the thoracic surface ausculted; and the relationship of pitch of the laryngeal and bronchophonic voices.

431. *First.* In regard of conduction of laryngeal sound, theory would support the inference, that as the human voice is best propagated in air, the more the lungs were rarefied, the greater would their conducting power become; and, in accordance with this, it is certain that intense bronchophony is sometimes heard over highly emphysematous tissue. However, on the other hand, as both the tracheal and bronchial walls themselves vibrate during speaking, any really solid material directly connecting a large bronchus with the surface of the chest, must conduct those vibrations forcibly; and, in accordance with this, we find that wherever solid fibrous structure is seated in the manner supposed, bronchophony of the most intense character is audible. But if the union of the solid material with the chest-wall be imperfect, if there be any interruption at the planes of union of the conducting materials, the acoustic conditions are completely changed, inasmuch as interruption at the union of media of different densities most deeply impairs the conducting faculty of the series. Here is one clue to the differences of vocal resonance, observed in cases where the physical conditions appear, on superficial view, identical; hence, too, we have no fair reason to expect that in all samples of the variable semi-solid states comprised under the title of "hepatisation," conducting power should be affected in an uniform manner,—as experiment shows that it actually is not. Experiment, in truth, alone can teach in each instance what the force of conduction really is in the various complicated conditions of physical change in the lungs.

432. *Secondly.* It is indubitable, that the bronchophonic voice is sometimes louder than that transmitted through the stethoscope directly from the larynx. The extreme rarity of this occurrence does not affect its reality; and hence, some explanation must be found for the increase of intensity within the thorax.*

433. There seem to be three ways, as far as now known, in

* Real increase of vocal force within the chest in any case of bronchophony has been denied as matter of fact. It is said the composition of the larynx renders conduction through its substance imperfect, and that the thoracic bronchophonic voice originates farthest to be compared with that audible through the stethoscope held to, or actually put into, the mouth of the speaker. But the objector forgets that the converse unhappiness might then be complained of, for the laryngeal voice is reinforced in the cavity of the mouth. Some singers make immense use of this reinforcing property of the mouth, thereby giving a peculiar character to their style; compare in this respect the genuine larynx-singing of Mario with the artificial mouth vocalizing of Roucou.

which a sound may be reinforced beyond the seat of its production;—by, what may be called, *unison-resonance*, by *consonance*, and by *echo*. In all three, reflection of sound is concerned; but the laws of that reflection are in each case different. This will be best understood from a tabular view of the differences of the phenomena. The reader will bear in mind that by *unison-resonance* is meant the reinforcement which occurs in the box of the guitar or violin when notes are produced from their strings, or when a musical-box, instead of being held in the air, is placed on a table: by *consonance* is understood the reproduction of certain notes of instruments or of the voice by other instruments, standing by: by *echo* is meant the well-known phenomenon of repetition of sounds.* All three agree in that the reinforced sound may exceed in intensity the original, and, besides, differ from this in quality.

The subjoined table, it may be well to observe, is to be read on the following plan. The original and secondary sounds are connected in regard of their place of production, in cases of *unison-resonance*, *directly*,—in regard of pitch, all notes of the octave are *secondarily intensified in unison*, &c.

Original and Secondary Sounds, how connected in regard of—

	Place of production.	Pitch.	Number of repetitions.	Number of Notes coexistingly reinforced	Time of production
In unison reinforced	Directly connected.	All notes of the octave intensified in unison	No true repetition; only swelling of original sound.	Never but one.	Both simultaneous.
In consonance	Separate but near.	A single note only of the octave (or its harmonies) intensified: that note is the fundamental note of the consonating body.	Only one.	May be one, and certain of its harmonics.	Both nearly simultaneous.
In echo	Separate, and more or less distant.	Same note only.	May be several.	None.	One distinctly sequential to the other.

* Strangely enough, Skoda's printed statements on the signification of "consonance" are not altogether free from apparent contradiction. Thus, in one place, he

434. Now the loudness of the bronchophonic voice is in all probability partly due, under different conditions, to each of these three agencies in turn.

435. There can be little doubt that, in the natural condition of the chest, the principle of *unison-resonance* comes into play. But it is totally unavailable in the explanation of the bronchophony of hepatisation, for the simple reason, that such *unison-resonance* is perfect, exactly in proportion to the *amount of air contained in the resounding space*. Imagine the box of the violin filled with any solid or fluid material, and what comes of its property of reinforcing sound? * Had this principle any influence in the generation of the bronchophony of pneumonia, its effect would obviously be to transfer the phenomenon to the healthy side of the chest, in cases where the solidification was limited to one lung.

436. I am not disposed to question that, under peculiar circumstances, there may be a repetition of sound by consonance, though this would be very difficult to prove; it does not appear to take place in hepatisation.

437. Echo, too, seems a very probable cause of reinforcement, and this in hepatised lung. The necessary conditions of reflection appear to be fulfilled: the tubes along which the voice is transmitted from the larynx are surrounded by semi-solid material, proper, when compared with healthy tissue, to reflect and concentrate the sound; while the air-cells and minute bronchi are closed to a variable distance, and prevent its divergence. The tubes resemble so many speaking-trumpets, and, just as in these instruments, the augmentation of sound is produced by reflection from their quivering walls; as this reflection tends to propagate vibrations (otherwise divergent) in the same direction, increased intensity of sound must be the result. And, further, if the reflected vibrations chance to be brought to a focus within a large tube, then *echo* will occur; and, as under ordinary circumstances, the

includes as examples of "consonance," both the reproduction of a note of the human voice by a guitar-string, and the strengthening of tone when a vibrating tuning-fork undergoes when held against a table, instead of being held in the air; that is, he includes under the term "consonance" both consonance and unison resonance, as I have defined them above. Yet, in a later page, he tells us that "consonating" voices only reproduce their own fundamental tones, and certain others numerically related thereto, that is, he excludes unison resonance, and hence, by implication, defines the phenomenon altogether differently. Vierte Auflag., pp. 37, 39. None of Sh. J.'s commentators seem to have perceived (at least, they certainly have not noticed) this very serious discrepancy.

* Every schoolboy knows the increase of tone given to the sounds of the Jew's-harp by placing it in the ordinary position for playing, within reach of a resounding cavity, the mouth, and there are few who have not accidentally learned the hopelessness of attempting to play, if the said cavity happen to be partly filled with catables.

echo may be materially louder than the original sound. But it may be inquired, how, upon this theory, is the admitted temporary diminution of bronchophony explicable? Conceivably, by the deadening influence of accumulated fluid in the tubes.* Under these circumstances, bronchophony would probably (I have not verified this conjecture) be heard at some point of the chest nearer the bifurcation of the trachea. Again, it is possible that certain changes of posture altering the relationship of the reflecting surfaces might interfere with the production of echo, by preventing the reflected sounds from coming to their usual focus. Besides, the position of the auscultator in respect of the focal point might prevent him from hearing an echo really existing.† The force of the echo will also rise, the smoother the bronchial walls, and the larger the tubes in which it occurs. And numerous other circumstances may be conceived, but scarcely proved, to affect the phenomenon. Among these, the composition of the gases within the bronchi may, for aught that is known, hold an important place: hydrogen has been proved to deaden sound greatly; the effect of carbonic acid, mixed with other gases and aqueous vapour, can only be ascertained from experiment.

438. *Thirdly.* As concerns the distance from the point of auscultation at which the reinforcement of sound within the thorax occurs; the further away, the less of the resonance will reach the surface: the amount, however, will be modified by the conducting property of the interposed media.

439. A little consideration will show that these three conditions of bronchophony,—conduction of laryngeal sound, increased intensity of this within the thorax, and proximity of site of the increase,—may or may not be directly as each other; one may be in a state favourable to, the rest unfavourable to, the formation of bronchophony. Hence the variable state of the sign in different cases of the same disease.

* The effect of carpeting, or woollen cloth of any kind, in deadening the sound of music in an apartment is well known. The intermixture of air and solid fibres in the carpets, through which the sound has to pass, deadens the echo between the ceiling and floor, by which the original sound is swelled.—Herschell, Art. "Sound," *Encyc. Metrop.* Aërated mucus and sanguineous serum in the bronchi would have the same effect on vocal echo in those tubes as the carpeting under the circumstances referred to above.

† The existing theories of echoes generally is inadequate to explain many of their phenomena. There is, or was, a famous fortress near Leamington well illustrating this. Here, if a person sings, he only hears his own voice, without any repetition; those who stand at some distance hear the echo, but not the voice,—and they hear the echo with surprising variations,—sometimes louder, sometimes softer,—now near, now distant.—Burrows's *Cyclop.*, Art. "Acoustics."

440. *Fourthly.* The relationship of pitch of the bronchophonic and laryngeal voices seems the most difficult part of the subject, —difficult, at least, in those cases where a distinct difference can be detected in the pitch of the two.

That the voice should, in travelling from one part to another, undergo alteration in pitch, seems, on first thought, opposed to the commonest experience and to the recognised laws of acoustics. And in experimentally investigating the point there are some easy sources of fallacy. Bronchophonic voice may be muffled and husky, while the laryngeal tone is pure; and the quality of the two may be essentially unlike. Now these differences may readily, unless great care be taken, be confounded with differences in pitch. Fully alive, however, to the possibility of such deception, I have endeavoured to guard against it; and am persuaded that the pitch of the bronchophonic voice does sometimes irregularly differ from that of the laryngeal. How, then, is the difference explicable? Conceivably (1) by the production of a new note within the chest chiming in with the laryngeal; or (2) by change of laryngeal note during conduction through *varying* media in the thorax.

(1) The production of new note within the chest is, we have seen, possible by unison-resonance, by consonance, and by echo. But the very name *unison-resonance* shows that this principle cannot be employed in explanation, when difference of pitch is concerned. Nor will the principle of consonance serve us either. For, though it is true that under favouring circumstances a note differing in pitch from the original one may be generated by consonance, that different note is always an harmonic of the original tone. Now, the difference of pitch we have under consideration is irregular and non-harmonic. Nor will echo help us through the difficulty; for though an echoed sound may differ from its original in intensity and duration, and even in quality, it always agrees with it in pitch.

(2) We are driven, then, to the phenomena of conduction through varying media for release from our difficulty. And though it would probably be impossible to *prove* that the change in pitch is thus actually effected in the chest, there is strong argument in favour of this mode of agency.

Thus (it appears from an experiment of Savart) “let a long flat glass ruler or rod, connected with mastic to the edge of a large bell-glass, perpendicular to its circumference, be very lightly supported in a horizontal position on a bit of cork, and then let the

bell-glass be set in vibration by a bow, at a point opposite the place where the rod meets it . . . In this combination, *the original tone of the bell-glass is altered, and the note produced differs both from that yielded by it, or by the glass-rod vibrating alone.*"* Again, Odier long since ascertained, that if hydrogen be breathed, the voice is *raised in pitch*.†

Now, here are facts showing that pitch may be modified by conduction from one kind of vibrating solid to another, and that the pitch of sounds is controlled by the nature of the gases in which they are produced. The application of these facts to our subject is sufficiently obvious; and, curiously enough, the revelations they afford on the question of altered pitch, lend unexpected support to Laennec in assigning the importance he does to conduction: they show that *one of the most important attributes of bronchophony is solely explicable by conduction*,—a point on which the followers of Skoda should meditate.

441. Finally, bronchophony seems to be a resultant, in lung-consolidations, of conduction and echo: in emphysema, of conduction and unison-resonance: in lung-excavations, of conduction, unison-resonance, and echo: in cases of tumor uniting a bronchus, or compressed pulmonary substance, to the surface, of conduction in the main, of unison-resonance in a secondary degree. Besides, when the necessary acoustic conditions exist,—that is, *when the tones of the laryngeal voice chance to bear a certain mathematical relationship to the fundamental note of a resounding space in the chest*,—true consonance may take a part in the production of bronchophony.

442. There are, besides, some subsidiary conditions, the influence of which cannot be doubted: viz., the density of the gases in the thorax, their composition, their temperature, and the quantity of fluid in the tubes.

But, even with all these aids, there are some peculiarities of voice-resonance inexplicable. How happens it, for instance, that in the great majority of persons, the voice naturally resounds much more forcibly under the right than the left clavicle?

443. The whole of this argument on the subject of bronchophony is reproduced *verbatim* from the edition of 1854. Subsequently, views, in many respects similar, have been taken by Hoppe, Wintrich, and others. Hoppe even goes so far as to argue consonance *cannot* arise under the circumstances which exist when

* Quoted by Henschell, *Art. "Soud,"* p. 807, *Lancet*, Metrop.

† *Ecl. Loe* p. 796.

bronchophony occurs; but in this extreme opinion I believe, for reasons fully set forth in the text, he is possibly in error. The most interesting recent contribution by far on the subject (especially so to me, because it gives additional force to the echo theory) is that of Professor Fenger, of Copenhagen.* This observer has ascertained that in certain cases of posterior hepatisation of one lung, the morbid vocal resonance and breath-sounds are not only audible over the entire breadth of the vertebral column, as has long been known [421], but that, on moving the stethoscope further out on the healthy side of the chest, the respiration and voice will be most distinctly found to retain a bronchial character at a certain distance beyond that column. Now this fact, which I can fully confirm,† may plainly be explained by simple conduction. But Dr. Fenger finds that the bronchial phenomena, having disappeared at a short distance from the spine, reappear or are reinforced at a greater distance from the same,—for example, at the inner edge of the shoulder-blade, or in some instances much further out towards the axilla and side of the chest. Now, here the theory of conduction evidently fails: it cannot explain the phenomenon of reproduced sound; and Dr. Fenger traces this with much success to the intervention of the laws of echo.

444. (B) *Mechanism of Ægophony*.—Ægophony, according to Laennec, is the natural resonance of the voice in the bronchial tubes, rendered distinct by the compression of the pulmonary texture, and tremulous by its transmission through a thin layer of fluid in a state of vibration. He thought it probable, also, that the flattening, which the bronchi undergo from pressure of the pleural fluid, had a good deal of influence in its production; the quality of resonance being such as might be anticipated from the shape of the vibrating tubes, resembling the mouthpiece of the bassoon and hautbois: it is not sufficient in itself for the production of the phenomenon; otherwise, ægophony would exist in cases of absorption with *contraction* of the chest, which is not the

* On Echoes in the Human Thorax, translated by Dr. Moore in Dub. Hosp. Gazette, Oct. 1856.

† Lusk, U. C. H., *Males*, vol. xvi. p. 207. "July 28, 1859. Whereas, about ten days ago, on ausculting below and within the inferior angle of left scapula, there was heard big, pitched bronchial breathing, well marked, whereas if bronchial breathing was traced with accurately the same characters across the vertebral column to the corresponding point on the opposite right side, now, respiration at the former point is bronchial, but weak, mixed with rhonchal sounds of different kinds, and respiration on the right side is full, exaggerated, with scarcely the least bronchial quality. On both sides the percussion normal to the right of the middle line." This was a case of left pleurisy with effusion. Also, Hall, U. C. H., *Males*, vol. xix. p. 33.

fact.* Laennec adduces various arguments in favour of these views, and affirms that by applying a bladder half filled with water over the larynx, the natural resonance is transmitted through the liquid with heightened pitch and slightly tremulous character. Skoda, holding that pure ægophony is audible in cases of pneumonia, and tuberculous infiltration, with or without cavities, as perfectly as where fluid exists in the pleura, and maintaining that a piece of liver interposed between the larynx and stethoscope will produce the same effect on the transmitted voice as a stratum of water, rejects Laennec's doctrine *in toto*. He believes that the tremulous character arises only from impulses of a solid body against some other body, solid, fluid, or aeriform,—impulses which cannot occur within the chest, unless the voice consonates therein in a space filled with air; and that, "probably" in most cases, the wall of a bronchus, in which the air consonates, re-acts through impulses on that contained air, and so causes ægophony: while it is also possible that the peculiar character may be occasionally given by "mucus, &c.," imperfectly closing the orifice of a bronchus, and imitating the reed in the mouthpiece of reed instruments. Dr. Sibson believes ægophony to be "pectoral resonance accompanied by whispering friction-sound; the two sounds are heard together, just as the drone and the notes of the bagpipe."

445. (a) Dr. Sibson's theory is plainly inadmissible; because pure ægophony may be heard without the least shadow of friction-sound accompanying respiration, and because in cases of hepatisation with slight plastic exudation on the pleural surface, there may be abundant friction-sound, while the vocal resonance is totally deficient in ægophonic quality. Besides, the chest-motion during speech is scarcely sufficient to produce friction-sound, which, at all events, could only be expiratory in rhythm. (b) If Skoda's main theory were well founded—that of the quivering re-action of bronchial tubes on their contained air—it seems difficult to understand why the bronchophony of hepatisation should not always be ægophonic; seeing that, as he himself teaches (what is of course true), vibration of the tubes always occurs when their contained air consonates. The subsidiary suggestion concerning the imitation of reed-instruments by bronchial mucus is ingenious and plausible. Yet, whereas marked bronchophony with more or less liquid rhonchus some-

* At least during the early period of such absorption; uniform or globular dilatation of the bronchi is well known occasionally to ensue at the advanced periods.

times exists over lung, at once emphysematous and bronchitic, I am not aware that an ægophonic quality has under the circumstances ever been detected: it may be rejoined, that the conditions of consonance do not exist here; but this would scarcely be a fair argument, as bronchophony (an alleged effect of consonance) does exist. (c) For my own part, believing as I do, that while other conditions may lead to a close simulation of ægophony, the pure quality described by Laennec depends upon the interposition of fluid, I look for the explanation of the phenomenon in some degree at least to that fluid. I admit at once that his experimental illustration of the doctrine fails in nine cases out of ten wholly;—in a number of trials with oiled silk bags, containing various thicknesses of water, it has occurred to me but once or twice to catch anything of the quivering character which Laennec affirms attends the vocal resonance. But how rude the imitation of the state of things in the pleura! And as it is certain the peculiar character can in rare instances be perceived, may not the success of the experiment in those cases depend on the relationship of the superjacent water and the resounding larynx having by accident become in regard of acoustic conditions identical with or closely assimilated to those of the pleural fluid and bronchophonic lung? M. Woillez appears to me to have thrown out a valuable hint (*Recherches sur l'Inspection*, p. 437, 1838) in suggesting that the tendency to a vacuum within the pleura exercises an important influence on the phenomenon: “a stratum of liquid,” as he observes, “no matter how thin it might be, could not vibrate so as to produce ægophony, if it were *compressed* between the lung and the chest-wall.” Further, the abruptness and the peculiar quality of ægophony are easily explicable by the intervention of liquid; the experiments of Colladon and Sturm have shown that the duration of sounds similarly produced differs notably in water and in air, and that their quality is completely different. Thus a bell struck under water gives not one as in air, but a quick sharp sound, as of two knife-blades clashed against each other.* Another and, in some respects, a very novel theory of ægophony will be found under the head of Musical Vibrations in their applications to Auscultation [467].

* *Annales de Chimie et de Physique*, t. xxxvi. pp. 243 and 251.

§ III.—RESONANCE OF THE COUGH.

I.—IN HEALTH.

446. If the stethoscope be applied over the larynx or trachea of a healthy person while coughing, the act of expiration is found to be accompanied by a sound of hollow character, varying in respect of graveness and intensity with the voice of the individual; the observer is not conscious of any sensation of succussion in the site of its production. Ausculted on the surface of the chest, the cough in health furnishes a quick, short, commonly dull and indistinct, somewhat diffused sound, produced at a distance, without hollow or tubular character, not attended with any distinct sensation of succussion in the interior of the thorax.

II.—IN DISEASE.

447. *The modified states* of the pulmonary cough, which occur in disease, are the *bronchial, cavernous, amphoric*.

448. *Bronchial cough*, when well marked, is a sound of harsh character; is attended with a sensation of very marked succussion in the chest, and a slight degree of impulsion towards the ear of the observer; is very rapidly evolved, and more concentrated under the instrument than the natural sound.

449. *Cavernous cough* is characterised by its perfect hollowness and metallic character. The sensation of production in an excavated space of limited size, the strong impulsion and transmission of the sound through the stethoscope with a force sometimes painful to the ear, are quite distinctive of this species of resonance. Cavernous cough may be pure, or associated with cavernous rhonchus; if fluid be present in the cavity to a moderate amount, it will not interfere with the production of the characteristic cough, and the forcible agitation the liquid matter undergoes during the act will of course be attended with rhonchus.

450. *Amphoric cough* is a loud resounding sound of metallic character, conveying the notion of production in a large space more or less empty; it is not forcibly transmitted through the stethoscope.

451. The varieties of thoracic cough are heard in the same cases as the corresponding varieties of respiration; they are of little utility in diagnosis. In pleuritic effusion, the quality of the cough is sometimes *megaphonoid*.

§ IV.—PHENOMENA COMMON TO THE RESPIRATORY SOUNDS, TO RHONCHUS,
 AND TO THE RESONANCE OF THE VOICE AND COUGH.

452. *(a) Nature and Characters.*—Differing from all the morbid conditions hitherto considered, the phenomena termed amphoric echo and metallic tinkling, attend all three acts of breathing, of coughing, and of speaking. These phenomena are fundamentally one and the same,—the echo of various sounds, reflected by the walls of a capacious hollow space within the chest, under circumstances modifying the force, concentration, quality, and pitch of that echo. Metallic tinkling is the term originally applied by Laennec to a clear, ringing, highly metallic, single sound, of very high pitch, not dissimilar to that produced by gently striking a hollow glass vessel of globular form with a pin. Its quality may, however, be more or less purely metallic, and its pitch fall, and its clearness diminish, the tinkling character gradually disappearing *pari passu*, till it gradually merges in the low-pitched sound of buzzing amphoric echo. In different cases, or at different times in the same case, this transition may be detected: and there is a certain stage of the transition in which it is difficult to determine whether the term metallic tinkling or amphoric echo be the most applicable. The metallic quality, though less clearly and sharply defined, is yet very obvious in amphoric echo,—which may be imitated with some success by speaking, breathing, or singing into an empty water-bottle.

453. Metallic tinkling, occurring in connection with respiration, co-exists commonly with (or rather echo-like, follows), inspiration, being prolonged somewhat into the succeeding expiration; it is very rarely limited to the latter. Generally speaking, it alternates irregularly with an amphoric state of the respiratory sounds, the one unnatural state giving place to the other, after a variable and for a variable number of respirations. It appears to the ear to originate indifferently either deep within the chest, or near the surface: and is rarely persistent for any considerable number of respirations. Amphoric echo may attend both sounds of respiration, or be limited to either.

454. Metallic tinkling of systolic cardiac rhythm may sometimes be heard in pneumothorax with perforation. This phenomenon, assimilable to cavernous rhonchus, produced in a cavity by the heart's action [339], I have only known to occur on the left side. Whether it is to be regarded as a metallic echo of the heart's

systolic sound, or as a result of the movement of the air within the pleural sac, through the heart's impulse, I am unprepared to say.

455. Generally audible at the central height of the chest, laterally or posteriorly (whence they may be propagated with gradually diminishing intensity to the surrounding parts), metallic tinkling and amphoric echo may be heard in every part of the thorax. The most clearly marked and intensely developed metallic tinkling I ever heard, was chiefly audible under, and a little outside, the nipple: the case was one of tuberculous perforation of the pleura.

456. (*b*) *Mechanism*.—The mechanism of metallic tinkling and amphoric echo has been long sought after with all the eagerness of curiosity; but observers are far from having come to a uniform conclusion on the subject. I believe, as just mentioned, that the two phenomena are one and the same, fundamentally,—echoes of different properties from the walls of a large space, more or less favourably disposed for reflection and concentration of sounds, produced either within the area, at the outlet, or in the close vicinity, of that space. It appears, too, that the low-pitched buzzing echo only requires the presence of air in the hollow space, though water, in moderate proportional quantity, may be present therein; while the high-pitched tinkle requires fluid for its production, —not that such tinkle is physically impossible unless fluid be present, but that in the chest, the conditions, independent of fluid, which are capable of generating it, do not co-exist. In experimental support of this statement, it may be observed, that if we blow, cough, speak, or sing, into an empty glass decanter, a low-pitched, buzzing, amphoric echo only will be produced; metallic and ringing in quality, it is true, but never of the tinkling pitch.* Let a little water now be placed in the decanter, and the result will be exactly the same, so long as the fluid is not agitated. But agitation of the fluid changes the character of the echo. Thus, let drops of water, slowly, and at distinct intervals, fall on the surface of the fluid in the decanter, and the ear, applied to the surface of the vessel, recognises the most perfect imitation of metallic tinkling; just as in certain instances the phenomenon occurs within the chest, independently of respiration, rhonchus, voice, or cough, when a patient, with a very large cavity, or with hydro-pneumothorax, suddenly changes from the recumbent to

* The fundamental and resonating note of such vessels is always of low pitch

the sitting or erect posture, and when, in all probability, a drop of fluid is precipitated from the roof of the cavity to the fluid on its floor. Or, again, breathe into the water by an elastic tube, and the bubbling will be found to produce a perfect tinkle.* It is probable, too, that sounds, generated in fluid, on the close confines of a cavity, itself free from fluid, may be echoed with metallic tinkle by that cavity. Metallic tinkle, so far as the human chest is concerned, seems to be essentially the echo of a bubble, or at least of a sound generated within liquid.

457. The morbid states in which these phenomena have been observed, are hydro-pneumothorax with and without bronchial communication, simple pneumothorax, and large tuberculous excavations in the lung-substance. In the first case, where the pleural cavity contains air and liquid, and opens into the lung, both kinds of echo may occur with respiration, rhonchi, speech, and cough. If respiration produce in any way single, isolated bubble-sounds, either by the bronchial fistula opening below the level of the liquid or otherwise, metallic tinkling will occur; if there be no bubble-sound, amphoric echo only will be heard: hence, if the fistula open above the level of the liquid, there will be amphoric echo, unless the fluid be by some means or other simultaneously agitated. Rhonchi produced in the communicating bronchial tube or tubes, will be echoed with tinkle, if their component bubbles be separately and, as it were, intermittently evolved; if otherwise, amphoric echo will be the result. The influence of speech or cough will similarly vary. Fournet has endeavoured to show that the occurrence of one or the other variety of metallic sound, tinkling or amphoric, will also be found to depend upon the freedom and rapidity with which the escape of air through the fistula occurs. If it make its way from the fistula by rare, slow, and successive bubbles, tinkling will be evolved; if the bubbles be numerous and closely following each other, amphoric echo will be the result. This idea seems to me well founded: if the drops of water be allowed to fall rapidly into the decanter, in the experiment I have already referred to, the sharp tinkle passes into the low-pitched and confused amphoric echo. Fournet further holds that (as the level of the fluid is in some cases capable of being changed with the position of the chest, and hence the relation of the fistulous opening to that level altered), the same opening may at one time be the possible source of

* The experiments of Dr. Bigelow (*Brit. and For. Med. Rev.*, vol. vii. p. 569), made post-mortem on a patient with hydro-pneumothorax, gave similar results.

metallic tinkling, at another, of amphoric echo. Again, if the size of the opening increase much, amphoric echo will take the place of tinkling; and, *vice versa*, if its calibre be diminished by obstruction with pseudo-membrane or otherwise. Both phenomena will cease, he holds, if complete closure of the opening be effected. It is, however, matter of certainty that either kind of echo may occur independently of communication between the pleura and bronchi; this last statement is consequently incorrect. In the second case of non-fistulous hydro-pneumothorax, the agitation of the fluid by coughing or by movement, or the fall of drops of fluid from the upper to the lower parts of the pleural cavity, and perhaps even the echo of rhonchi in the adjacent bronchial tubes, will cause tinkling. Thirdly, metallic echo, and even tinkling, both vocal and tussive, we are assured by some observers, have been heard in cases of simple pneumothorax, in which there was neither liquid effusion, nor perforation of the pleura. Low-pitched echo may intelligibly be produced under the circumstances; but the absence of fluid, especially where vocal sound is the alleged cause of the phenomena, makes it desirable that, in respect of tinkling, the observation should be repeated. On the clinical rarity of *simple* pneumothorax it is needless to insist. Fourthly, large dimensions are an essential character of pulmonary cavities, that give either variety of metallic echo: all the four modes of production of both varieties may come into play within them.*

458. That the metallic phenomena should be, as is the fact, best heard in connection with coughing and speaking, is just what might have been anticipated: these acts require greater force of respiration than ordinary breathing; they are, therefore, on the one hand, capable of propelling air through a passage which would have resisted its progress under a less impulsion: and, on the other, they themselves being more sonorous, more readily lead to audible echo. Forceful and deep respiration will produce somewhat similar effects.†

* I must admit, however, in respect of the necessity of the presence of fluid as a condition of metallic tinkling, that I have met with one or two cases where I was not perfectly sure, though true metallic tinkling existed, that liquid was present.

† Dr. Dabell (*Lectures on Chest Disease*) argues that metallic tinkling is not unison resonance, for it follows the first sound, and does not reinforce it, not consonance, for it has no fixed harmonic or unison relation to the first sound, and not echo, for it is not a repetition of the first. It is a new sound, due to the sonorous vibration of the wall of a cavity, through a gust of air playing on the hard wall on its margin. It resembles in mechanism the sound of an Arabian harp struck by the breeze.

§ V.—SOUNDS AND MURMURS OF THE HEART, AS TRANSMITTED THROUGH
THE SUBSTANCE OF THE LUNGS.

459. In order to avoid repetition, I must refer the reader to the Volume on "Diseases of the Heart," for an account of the mode and extent of propagation of the heart's sounds in the normal state of the thoracic organs: there, too, are described the changes in transmission of its sounds produced by disease of the heart itself and of the great vessels. We will here only deal with cases where, the heart and great vessels being healthy, morbid states of the lung and its appendages, by changing the conducting power of the media intervening between that organ and the surface where auscultation is performed, pervert the natural mode of propagation. Now, inasmuch as the physical sources of sound in the heart are fluid and solid only, and aeriform matter has no direct connection with them, the displacement of air in the lung, either by fluid or by solid matter, would be favourable in theory to the conduction of the cardiac sounds through the pulmonary substance: while increase of air within the thorax would have the contrary effect. And so the positive intensity of sound produced in the heart remaining unaltered, its relative intensity, as discovered at different parts of the thoracic surface, might be changed.

460. Experience supporting, in the main, this theoretical consideration, teaches us that whenever the cardiac sounds (the heart itself, the great vessels, and chest-walls being healthy), are found to be of greater intensity at any given point of the thorax, than at some other point nearer that organ, the lung, pleura, or mediastina have either in the former situation undergone some change, rendering them unusually good conductors of sound, or, in the latter situation, undergone some alteration diminishing their conducting power. The anatomical state in the first class of cases will be one of condensation or induration; in the second, of rarefaction.

461. Increased intensity of transmission of the heart's sounds is thus observable in pneumonia, chronic pulmonary consolidation, tuberculous disease, extensive pulmonary apoplexy, and œdema, dilatation of the bronchi, cancer of the lung, and solid accumulation in the pleura or mediastinum. The influence of pleuritic effusion will vary with its amount; the sounds, as a rule, will be better heard through a small extent of badly-conducting lung, than through a large mass of better-conducting fluid. Hitherto

phthisis has been almost the only affection in which this means of diagnosis has been commonly applied. If the heart's sounds be more distinctly audible under the right than the left clavicle, if the excess be sufficiently marked to leave no doubt as to its reality in the mind of the observer, and if the absence of cardio-vascular disease be certain, the circumstance, in conjunction with the locality of its existence, affords presumptive evidence of tuberculation. Generally speaking, other signs of a more direct character are observed at the same time; but in certain cases of incipient and rather deep-seated tuberculous deposition, it is often a source of satisfaction to have this additional sign to apply to. Its absence would not, however, by any means impugn positive evidence of consolidation derived from other sources. Whatever be the cause of the sign, it is for obvious reasons more readily substantiated at the right than the left side.

462. Diminished intensity of transmission of the heart's sounds, on the other hand, accompanies highly marked emphysema. The importance of this fact is habitually acknowledged in respect of the præcordial region, where the sounds may be almost completely muffled by an intervening thick mass of rarefied lung; but the sign may be established elsewhere. Thus, in a case of intense emphysema of the left lung, to which the disease was limited almost completely, and especially marked at the posterior aspect of the chest, I some years ago detected that the heart's sounds were considerably more distinct posteriorly on the right than the left side. As there was no evidence of induration of the right lung, and as the sounds there were not louder than is sometimes observed in healthy individuals, the difference on the two sides could only be ascribed to diminished conducting power on the left. This sign, in the rare cases where it could be established, would appear to warrant the diagnosis of general emphysema of the substance of the lung in its deeper parts, as well as on its surface, —a point of some importance; for diagnosis, as well as anatomical investigation after death, generally aims too exclusively at the detection of superficial emphysema. The influence of pneumothorax varies; as a rule, it impairs the force of the sounds, but sometimes they seem to resound in the pleural cavity, as they do in a flatulent stomach, and so become intensified: I have observed this variation within twenty-four hours.

When the conducting influence is a weakening one, the observer should specially notice the second sound of the heart; when an intensifying one, the first.

463. Whether the heart's sounds may be modified in the course of transmission in virtue of any other principle than conduction, will be elsewhere considered. The conduction of cardiac *murmur* obeys the same laws as that of its sounds.

264. *Subclavian and Pulmonary Murmur.*—Does any condition of lung contribute to the generation of either cardiac or vascular murmur, independently of disease of the heart, or of those conditions of the blood, spasmic and other, which render its movement soniferous? I know of no such mechanism in regard of the heart; but there is every reason to believe that, as an effect of certain states of the lung-substance, murmur may arise in the course of the subclavian and the pulmonary arteries.

(a) Dr. Stokes long since pointed out the occasional presence of blowing murmur, limited to the subclavian artery adjoining an apex consolidated by tubercle; referring it mainly to the pressure of the flattened infra-clavicular region and the hardened lung-tissue. He noted its disappearance after local leeching or hæmoptysis.* I had found, in addition, that the nature of the consolidation was a matter of indifference; that the murmur rarely exists on both sides, was more common on the left than the right, and in men than women; that it occasionally disappears and reappears in the course of a few minutes; was sometimes removed by change from the sitting to the lying position, and *vice versa*, and even by brisk rotation of the arm; and that it varied in quality, pitch, and abruptness, from soft blowing to sharp whistling.

Dr. Richardson proved that this murmur might occur in perfectly healthy persons (never in children, and very rarely in females), especially when the arm is held at right angles to the shoulder.† Dr. Palmer found it well defined in 102 of 497 healthy working men between the ages of sixteen and forty-five, in twenty-three cases on the right side, thirty-one on the left, and twenty-eight on both sides.‡

Evidently subclavian murmur is simply a *pressure-murmur*, roughly assimilable to that producible by bearing with a stethoscope on an external artery. The mechanism of the requisite pressure is two-fold. First, it may be wholly *physiological*. The causes then will be,—inspiratory squeezing of the vessel against the first rib by the air-distended apex of the lung (Kirkes, Sibson); pressure of the vessel by the subclavius muscle against that

* *Dis. of the Chest*, p. 414, 1837.

† *Auscultation*, vol. i. p. 1, 1862.

‡ *Lancet*, September 5, 1863.

rib (Richardson); and diminution of the calibre of the vessel by the inspiration-rise of that rib (Palmer). Secondly, it may be *pathological*. An efficient pathological cause will arise from any condition of lung maintaining permanent, or lending itself to occasional, pressure on the vessel. But the actual production of the murmur by such conditions, as a matter of fact, is constantly interfered with. Acquainted with this murmur for the last twenty years, as a possible accompaniment of phthisis, I scarcely ever meet with it. I presume this must depend on the diminution in the statical bulk of the apex, and the deficient enlargement dynamically by inspiration, attending the deposition of tubercle: so that phthisis would be a cause at once of production and of prevention of the murmur.

465. (b) Many years ago Dr. Latham drew attention to the frequent coincidence of a soft, blowing, systolic murmur, limited to the pulmonary artery, with a tuberculized state of the lung. I can testify to the real occurrences of such murmur; but I cannot help believing it to be of extreme rarity.

The mechanism of this murmur requires further elucidation: but, in all probability, it is essentially the same as that of the subclavian variety. Pressure would probably with yet greater difficulty be effected in the site of the pulmonary than of the subclavian artery,—hence the former would, still more rarely than the latter vessel, prove the seat of actual murmur in phthisical persons.

§ VI.—MODIFIED METHODS OF AUSCULTATION.

466. So far, we have considered auscultation in its application to sounds produced within the chest by natural acts of the individual ausculted. Two other methods of procedure, at least, have been invented, and deserve some notice.

A.—AUTOPHONIA.

466*. Thus, attempts were many years ago made by the late M. Hourmann to connect peculiarities in the resonance of the observer's own voice (as he speaks with the ear applied to the chest directly, or with the intervention of the stethoscope) with certain definite conditions of density of the parts beneath. Few auscultators can have failed to notice that, while their voices sound with strong vibration from some chests, or from certain parts of these, no such resonance occurs from others. When such

resonance does occur, it is greatly more marked when the solid, than the hollow, stethoscope is used. I have, however, not found any condition of lung uniformly attended by, or uniformly free from, this sort of resonance, called autophonia by Hourmann; nay more, it may be so strong over an *abdominal* tumor, as to cause pruritus of the ear applied to the stethoscope.* I consequently, in the present state of knowledge, attach to it no clinical value. I have known this resonance assume ægophonic quality in pleuritic effusion.

II.—METHOD BY MUSICAL VIBRATIONS.

467. Experiments have been made by Drs. Stone and Grabham† on auscultation by the aid of musical vibrations. Dr. Stone's method consists in "communicating a musical impulse to the air in the bronchial passages by forcibly inspiring through a tube or pitch-pipe containing a free reed. The note emitted is directly conveyed to the parts under observation." Dr. Grabham fixes a pleximeter steadily on one side of the chest, sets a vibrating tuning-fork upright upon it, and then listens to the transmitted sound at various spots on the opposite side.

It seems to me very likely both of these plans might lead to results of clinical significance; but I am not aware that any have been made public by either of the above observers.

More recently Dr. Stone has been led by his method to the following conclusions concerning the mechanism of ægophony. 1. *Autophony* does not accompany a musical sound drawn into the trachea. 2. It does not accompany a singing note of the patient's voice. 3. Directly certain sounds are vocalized by articulation, ægophony appears. 4. These sounds are those of vowels which, as shown by Helmholtz, are accompanied with high harmonics,—namely, *e*, *oo*, and *ah*. 5. *Ægophonic* voice, then, appears to consist of the harmonics of certain sounds which continue audible when the fundamental notes are stopped by a layer of incompressible fluid,—the rapid vibrations of the acuter harmonics passing through the fluid more readily than the slower ones of the graver foundation notes.

This theory supplements the view adopted in a previous place [447]; and seems in extreme probability to be well-founded.

* *Dorset's Enlarged Spleen*, U. C. H., *Malac.* vol. 1 p. 198.

† *Lancet*, vol. 1 p. 114, 1867.

C.—AUSCULTATORY PERCUSSION.

467*. This method of diagnosis, which combines percussion with mediate auscultation, marks difference of pitch in tones with greater precision than simple percussion. When the difference of percussion-pitch of any two parts, as in the case of the liver and heart, is but slight, the line of union of the two may be very accurately defined by this method. The ear applied to a solid stethoscope receives the percussion-sound with much greater force than if diffused through the air. For details I must refer the reader to the very suggestive paper of the inventors, Drs. Camman and Clark.*

SECTION VI.—SUCCUSSIO.

468. It has been seen that the succussion of certain contents of the chest, produced by the heart's impulse, and by the act of coughing, may give rise to physical phenomena of diagnostic import. And it was known to Hippocrates that if the chests of certain patients, labouring under thoracic diseases, be shaken, a "sound may be heard on the affected side." Among these he ranked empyema, in cases where the "abscess had been opened,"—where consequently a communication existed between the cavity of the pleura and the external air.† The phenomenon retains to the present day the name of Hippocratic (as also thoracic) succussion-sound.

468*. The *succussion* necessary for the production and detection of this physical sign may be performed by pushing the patient's trunk abruptly, but with gentleness, forwards and backwards, while the observer's ear is applied to the chest; or the patient may himself move his chest once or twice in the manner indicated. The sound resembles closely that perceived on shaking a decanter, partly filled with water, close to the ear. Like that, it is a gurgling splashing noise, the precise tone of which varies with the density of the fluid, and the proportional quantities of fluid and of air present. It differs in point of intensity according to the suddenness and force of succussion; but it may be so easily produced as to be detected on the least movement of the patient, or during coughing. It may be audible at a distance from the chest, and be heard, while the splashing movement is felt, by the patient

* New York Journal of Medicine, July, 1849.

† De Morbis, lib. ii. 45.

himself: and is, or is not, accompanied with metallic tinkling. Its duration varies greatly,—it may last for years, though this is very rare: in such chronic cases it is perceived by the patient, as he walks down-stairs, rides on horseback, or moves the trunk abruptly. It is not invariably a persistent condition when once developed; within twenty-four hours it may be present and cease to be producible, to recur again within a short period.

469. Produced by abrupt collision of air and liquid in a unison-resounding or echoing space of large dimensions, the sound under consideration may be detected in hydro-pneumothorax, with or without bronchial fistula, and is occasionally to be heard in tuberculous excavations of unusually great size. Commonly audible over the general surface of the affected side, it may be limited to the anterior regions.* The sign is, however, by no means always to be discovered in hydro-pneumothorax: and one reason of its absence—thickness, and proportional excess of purulent fluid—was mentioned by Hippocrates;† it is certainly true that the thinner the liquid, the more readily is the sound produced.‡

Laennec points out the possibility of confounding the noise produced by shaking the stomach, when much distended with gas and fluid, with true thoracic succussion-sound; and M. Fossagrives is yet more strong in his apprehension that the error is actually frequently committed. I confess it appears to me that with a little care on the part of the observer the mistake may be avoided.

SECTION VII.—DETERMINATION OF THE SITUATION OF CONTIGUOUS PARTS AND ORGANS

470. The object of attempting to determine the situation of other parts than the lungs themselves, when the diseases of these organs are the subject of investigation, is, as might be anticipated, to infer from any change in that situation the existence of some pulmonary affection capable of producing it. Experience has shown that such displacements do occur: and further, that when present they are among the most conclusive, as they often are the most readily ascertained, signs of the associated pulmonary affection.

471. The organs and parts liable to undergo displacement in consequence of pulmonary disease are—The Heart, the Mediasti-

* Louis, *Phthisie*, ed. 2, p. 412. Paris, 1813.

† *Idem*, by Forbes, *Arctur*, edit. p. 541.

‡ Huxley, *U. S. M. Females*, vol. x. p. 91: the spleen imperfectly sonorous during life, the pos. very thick at *post-mortem* examination.

num, the Diaphragm, the Liver, the Spleen, and the Stomach. The existence of displacement of these parts and organs is determined by means of various other methods of physical diagnosis,—by inspection, by application of the hand, by percussion, and by auscultation; very rarely by mensuration.

472. The Heart may be removed from its normal position by Detrusion, Elevation, and Procidentia.

473. *Lateral detrusion*, for obvious reasons more readily detected when occurring towards the right side, is there commonly associated with procidentia,—to the left, with some degree of detrusion, backwards and upwards. The progress of the displacement to the right side is usually gradual from its commencement till it has attained its greatest amount, when the organ pulsates between the fifth and seventh ribs to the right of the nipple. On the left it may be pushed almost under the axilla, its point being at the same time raised the width of an intercostal space, or thereabouts, and carried backwards towards the scapula.

474. Pleuritic effusion and hydro-pneumothorax are the affections which drive the heart sideways to the maximum amount; simple pneumothorax is a rare cause; hæmothorax is rarely copious enough; and hydrothorax, being generally double, rarely displaces the heart in this precise manner. Intrathoracic tumors and aneurismus,* variously placed, sometimes produce this effect; hypertrophy, as well as emphysema, of either lung, are among its occasional causes,—hernia of the intestines through the diaphragm into the left pleura is an infinitely rare one. Besides, the heart may be *drawn* as well as *pushed* sideways—a mode of displacement that occurs in some cases of rapid absorption of pleuritic effusion, of pneumonic consolidation with marked contraction of the substance of either, but especially the right, lung, of pulmonary cirrhosis, of pure atrophy, and also of great diminution of bulk from tuberculous destruction of the same organ.† The practical interest of this matter is mainly connected with pleurisy.

475. The heart can scarcely be pushed forwards by any lung-affection, except emphysema; and various more prominent conditions, such as the distension of a thick stratum of lung in

* To an enormous extent in Marriault, U. C. H., Males, vol. xii. p. 5.

† I have twice, at the Consumption and University College Hospitals, seen the heart permanently beating in the right thorax, where no pleuritic effusion on either side had ever existed, as far as could be made out by present signs or past history, where the liver and spleen lay in their natural position, and where great tuberculous excavation and destruction of the right lung seemed to have drawn the heart in that direction, aided by perhaps the *detrusive* influence of hypertrophy of the inferior and non-tubercularized part of the left lung.

front of the organ, tend to mask this displacement. Intra-thoracic tumors and aortic aneurisms lying behind the heart, push it forwards, and, especially in the latter disease, give rise to very peculiar signs.

476. *Elevation* of the heart above its natural level—a displacement of very, very rare occurrence as a consequence of pulmonary disease, or of diaphragmatic hernia, though sufficiently common in cases of abdominal tumor,* ascites and gastro-intestinal flatulence—is sometimes seen as an effect of diminished bulk of the apex of the lung. Such diminution only occurs in tuberculous disease, and is produced by atrophy of the lung-substance, closure of air-cells, and contraction of exudation-matter, or by lessening area of cavities. I have never observed the apex raised higher by this cause than the fourth rib and third interspace: but in ascites, both in the male and female, and in ovarian dropsy, I have known it impossible to feel any impulse lower than the second interspace.

477. In *proidentia* of the heart the organ, lying below its natural level, is carried somewhat towards the median line; the impulse then is much more decided at the epigastrium, especially between the ensiform cartilage and left false ribs, than in the cardiac region. The common pulmonary cause of this displacement is double emphysema, of which it furnishes one of the most characteristic signs. It rarely exists to an appreciable extent in double bronchitis, if there be no emphysema; neither does double hydrothorax commonly induce it. The advance of tumors in certain situations may of course conceivably carry the heart downwards, but clinically this influence is rare.

478. The *mediastinum*, at its lower part, is of course carried to the right or left by such morbid states of the lungs or pleura as produce lateral displacement of the heart. Superiorly, above the third rib, the mediastinum may be encroached upon by the lung, without any displacement of the heart, and be sometimes pushed more or less to the opposite side. Emphysema of either upper lobe will produce this effect, and if both organs are implicated, the mediastinum may be, as it were, obliterated by its pleural borders being brought into close juxta-position; the approximation of the edges of the lungs may take place so high

* I have known the heart permanently raised an intercostal space by the splenic enlargement of *leucocythemia*. Case of De laet, U. C. H., Males, vol. x. p. 192, June, 1850; also C. Hayes, U. C. H., Males, vol. x. p. 212. Enlargement of the liver from abscess will also raise the apex. Case of Fairbank, Clin. Lect., Lancet, Dec. 1849.

as the sternal notch: the percussion-sound will of course be of unnaturally full and pulmonary tone at that point. Tumor connected with the upper part of the lung, circumscribed empyema, tuberculous accumulation in the pleura, and acute hepatisation, may cause encroachment on the mediastinum, with morbid percussion-sound: tuberculisation of the lung itself never, except perhaps quite at the outset, produces this effect, the disease tending to diminish the bulk of the organ—hence occasionally a valuable aid in diagnosis. It is unnecessary almost to add, that mediastinal tumors alter the relationships of the mediastinum; and that diseases of the great vessels, and of the heart likewise, deeply affect them.

479. *The Diaphragm.*—The alterations in position of the diaphragm will be discussed in the section on the diseases of that muscle [530].

480. The *liver, spleen, and stomach* may be raised above, or depressed below, their natural level, by conditions altering, as described further on, the position of the diaphragm; and thus become affected with *Elevation*, or *Procidencia*. These alterations of position are more readily detected in the case of the liver than of the other organs named; and have for this reason attracted more attention on the right than left side. Great distension of the stomach with gas will carry its tympanitic or anaphoric percussion-note actually as high as the axilla.

SECTION VIII.—PRESSURE-SIGNS.

481. I propose under this head to place before the student a succinct account of certain physical effects, produced on the wall of the thorax, on its contents, or on parts adjoining; and which are clearly due to pressure exercised from within the chest. Some of the most positive and easily ascertained evidences of intra-thoracic disease, are furnished by these pressure-signs.

482. They are divisible into two classes:—those where pressure, acting from the centre towards the periphery, exhibits its effects on the wall of the chest (eccentric, centrifugal, or outward pressure-signs); and those where the compressing force, playing in the direction of the chest's centre, physically interferes with internal parts (concentric, centripetal, or inward pressure-signs).

483. *Outward pressure-signs.*—Here range themselves expansion [31] and bulging [32] of the chest-wall, or above the clavicle; protrusion of the intercostal spaces; dislocation of the

clavicle forwards; detrusion forward of the sternum and costal cartilages, locally or generally; pressure on the vertebral column, and eventually, through destruction of a portion of this, on the spinal cord; downward detrusion of the diaphragm; and intercostal paralysis from pressure on the nerves of that name.

484. The conditions causing this variety of sign, are as follows:—Enlargements of organs, as hypertrophy of the heart and of the lung; loss of elasticity of the lung, combined with atmospheric pressure acting from within outwards, as in emphysema; accumulations of gas, as in pneumothorax; and of fluid, as in pleuritic and pericardial effusions; solid formations in the mediastina and pleuræ; aneurisms of the great vessels; infiltrations, plastic and solid, of the parenchyma.

The evidences of pressure produced by these various diseases, as well as the mechanism of the pressure itself, vary greatly, and will be described with the history of the individual diseases themselves.

485. *Inward pressure-signs.*—Inward or centripetal pressure may act on the heart, especially the right auricle; on the aorta, innominate, either subclavian or pulmonary arteries; on the vena cava, superior and inferior, the innominate veins, the pulmonary veins, and the azygos; on the trachea, bronchi, and lung-substance; on the vagus, recurrent, phrenic nerves, pulmonary plexus, and the sympathetic at the root of the neck; on the œsophagus; and on the thoracic duct.

486. Centripetal pressure acting on the *right auricle* diminishes its capacity, lessens the quantity of blood reaching the lungs, and adds in one form to the dyspnoea induced by other causes. Influencing the *pulmonary artery*, its effects are in essence the same, but obstruction of this vessel more effectually loads the entire venous system tributary to the right heart. Compression of the *aorta* gives rise to certain physical signs, especially arterial thrill and systolic (possibly even diastolic) murmur; but I have not actually known it carried far enough to obstruct the calibre of the vessel seriously. Influencing the *innominate* or other *subclavian artery*, it weakens the corresponding carotid and radial pulses. Pressure on the *superior vena or innominate veins* distends the internal and external jugular, subclavian, axillary, superficial thoracic and superior epigastric, facial, frontal, and even dorsal veins; and produces a tumid spongy fulness of the base of the neck,* swollen livid discoloration of the face and lips (which look

* The capillary vessels, as well as the radicles of the veins, are distended, on parts of the neck presenting this spongy appearance. Were the veins alone impeded,

in extreme cases distended almost to bursting), and œdema of face, arm, and affected side of the thorax or the chest generally. The sinuses of the dura-mater become clogged, and heaviness, stupor or actual somnolency ensue. Besides, the venous congestion of the brain entails cephalalgia and failure of motor and sensory power in the limbs generally: but I have never seen, even in cases of venous distension, so great that rupture of the cervical and facial veins might be supposed capable of occurring under the slightest over-strain, any approach to epileptiform seizure,—a fact of obvious practical import in connection with the alleged influence of so-called cervical “phlebismus,” as the exciting element of the epileptic fit.

Encroaching on the *inferior vena*, pressure entails distension of the abdominal veins, congestion and enlargement of the liver, congestion of the kidneys and slight albuminuria, various gastric disturbances, anasarca of the lower limbs and abdominal walls, and eventually ascites. But as matter of actual experience, it is remarkable how seldom intra-thoracic growths press in the right direction to entail this particular set of effects,—and so infinitely rare is it for aneurism of the thoracic aorta to produce them, that should anasarca of the lower extremities appear in a case of the kind, some other cause must be sought for the occurrence.

Obstructive pressure of the *pulmonary veins* leads to dyspnoea, hæmoptysis, œdema of the lungs, and hydrothorax.

From the special tendency of tumors to form about the right bronchus, the *vena azygos* must frequently be pressed upon, and its obstruction must interfere with return of blood from the vertebral sinuses, and cause congestion of the cord; now such congestion was in all probability the source of torpor, formication, and feeble motor power in the lower extremities in a case of mediastinal tumor seen some time since with Dr. Bascome.

487. Forcing the *trachea* backwards, or to either side, pressure induces stridulous breathing, and weakness of voice (traction of the recurrent nerve may have something to do with both these symptoms); its effects on the *main bronchus* have already been referred to, and sequential to these, exaggerated respiration may be established in the other lung. Pressure on the *lung-substance*

there would be discolouration of skin, which does not necessarily exist at all, and there would be nothing of the slightly erectile feel in the part, which is well known to the clinical observer. Doubtless, actual mechanical production of one variety of the state I have described under the title of *Angiectoma* (cyclop. of Anatomy, art. Products, Adventitious, p. 127) takes place

may force even the persistent air [122] completely from all the texture concerned.

488. Acting upon the *vagus and phrenic nerves*, and *pulmonary plexus*, pressure variously impedes and perverts respiration, and similarly disturbs cardiac action; involving the *recurrent nerves*, it variously modifies the voice, induces paroxysmal cough of hooping or croup-like character, and obstructs respiration more or less suffocatively.

In cases of aneurism of the arch, and also of intra-thoracic tumor, contraction of the pupil on the affected side is occasionally observed.* It seems certain, as suggested by Dr. Guirdner, that this must be a result of pressure on the *sympathetic*, whereby paralysis of the dilating influence of that nerve on the iris is induced, and, so, the antagonistic contracting influence of the third pair allowed full play. It is remarkable enough, that the pupil thus statically changed is not of necessity dynamically interfered with: I have found it act as briskly as its fellow.† With the progress of a case of aneurism, the pupil which has been distinctly smaller, may become of natural size;‡ but whether because the sac has, from taking a new direction for its enlargement, ceased to press on the sympathetic, or because it acts irritatingly, and so excites the dilating fibres of the iris, I am unable to say.

I have known unilateral deafness occur on the affected side in cases of aneurismal tumor of the arch; unquestionably another pressure-phenomenon.§

If the *œsophagus* be encroached upon, dysphagia may ensue,—not necessarily, however, unless the obstruction be very great, as will hereafter be fully shown. The dysphagia of aneurism and tumors within the chest is often rather an effect of irritation of the motor nerves of the pharynx or œsophagus than of direct mechanical obstruction.

If the *thoracic duct* be pressed on, unusually rapid emaciation will theoretically ensue: but actually observed cases are wanting.

489. The essential causes of the entire class of inward pressure-

* The earliest instance of the fact recorded in this country was in the case of Mack, U. C. H., Males, vol. ix. p. 211, April 23, 1853. Edition of 1854 p. 750. A case of the kind, I have since learned, had, however, been seen by Dr. Macbennell, of Montreal, as early as 1840. The wonder is the phenomenon had not been observed long before, as the experiments of Petit and Molinelli, on the sympathetic of dogs, as early as 1750, showed such an effect might be looked for.

† Case of Mack, loc. cit.

‡ Casey, U. C. H., Males, vol. xii. p. 31, June, 1855.

§ Mortuary, U. C. H., Males, vol. xi. 18.5.

signs are tumor and aneurism, and to a slight extent enlargement of the heart. It is a clinical fact of deep signification that gaseous and fluid accumulations do not induce them: it is to be presumed, because the pressure of those materials is equally spread in all directions towards the periphery of the sacs in which they collect; whereas tumors grow "where they list," and hence, as it were by accident, specially towards limited spots of surface.

SECTION IX.—PHYSICO-CHEMICAL CHARACTERS OF THE AIR OF EXPIRATION.

490. The variations in the physico-chemical characters of the air of expiration are of occasional diagnostic signification,—and would prove so much more frequently, had they been more fully studied.

491. The temperature of expired air in health has been calculated at 99.5° Fahr. by Valentin, at 98.6° by Moleschott,—the surrounding atmosphere being of medium temperature. In estimating its rises or falls in disease, the number of respirations per minute must always be taken into account; as the longer inspired air stagnates in the chest, the warmer will it make its exit: the temperature of the expired air and the frequency of breathing are, as a rule, inversely as each other.

492. The temperature sinks in pneumonia both from the diminution of surface, apt for chemical action, and the increased frequency of respiration. In various other pulmonary diseases, a similar fall in the thermometric heat of the expired air occurs through the same mechanism,—for instance in asphyxiating bronchitis.* In various general diseases, implicating the blood, the expired air is more or less cool,—strikingly so in cholera Asiatica.

493. The expired air rises above the natural temperature in acute febrile (non-pulmonary) diseases, during their period of sthenic re-action.

494. The quantity of watery vapour held in solution by the air of expiration varies,—from the experiments of Moleschott it appears sometimes to fall below, sometimes to reach, the saturation-point.

495. It is said that the expired air in the algide stage of

* Murphy (asphyxiating capillary bronchitis), U. C. H. Males, vol. x. p. 152, Jan. 1844. Temperature of ward 57° Fahr., of surface of right cheek, 96.50° ; under tongue, 97.33° ; of expired air (thermometer held close to the lips), 65° .

cholera sometimes becomes visible, with a surrounding atmospheric temperature, producing no such effect on the breath of healthy individuals. This would prove an excess of watery vapour.

496. The air and moisture of expiration in the state of health are odourless at the moment of their exit; if they be kept in closed vessels, however, putrefaction occurs, and ammonia is evolved.

497. In disease very sensible peculiarities of odour are observable: in sacccharine diabetes, a sweet hay-like smell; in pyohæmia a mawkish sweet odour *sur generis*; in Bright's disease, a special modification of urinous odour;* in phthisis, a faint nauseous odour is frequent, and when plainly present is actually not without diagnostic signification.

498. The share of carbonic acid in the air of expiration is said to be increased in intermittent fever, scurvy, and purpura; also in the phlegmasiæ generally, with the exception of those directly implicating the organs of respiration and circulation. The proportion, it is affirmed, falls in pneumonia, pleurisy, pericarditis, phthisis, variola, measles, erysipelas, roseola, scarlatina, erythema, dysentery, chronic diarrhœa, typhoid fever, and suppuration. Bronchitis is said to be without influence on the amount expired.†

These vague results, many of them self-contradictory, have little claim to the attention of clinical observers; they are treated with considerable scorn by Lehmann.‡ Confidence, on the other hand, appears due to the careful experiments of Hannover, from which it follows that the excretion of carbonic acid increases very materially in chlorosis,—a new element of confusion of our physiological ideas, however; for here is precisely the affection in which the ratio of red discs falls lowest. Hannover has also estimated the carbonic acid in phthisis. The elaborate observations of Doyère,§ undertaken with an instrument of rare and very ingenious construction, in cases of cholera, deserve attention. His experiments prove a reduction in the quantity of carbonic acid produced, and of oxygen absorbed, and a fall in the normal numerical ratio of the two.

* If this odour be deficient in the breath of a patient suffering from the class of symptoms called *uræmic*, Fresch's hyposulphuric acid test will also, as I have found by a considerable number of trials, fail to show the presence of ammonia in the expired air.

† Vide Bequerel and Rodier (Pathological Chemistry, by S. T. Spear, M.D., p. 418).

‡ Physical Chemistry, by Dr. Davy, vol. iii. p. 250.

§ Méta. sur la Respiration dans le Choléra, Paris, 1863.

499. The quantity of carbonic acid exhaled, instead of maintaining the normal average from 3 to 5, may in certain of these diseases rise to 8 or fall to 1, per 100.

500. In the state of disease it is very probable considerable variation exists in the amount of oxygen lost in inspiration; and chemists conjecture that probably the ratio of health between the liberation of carbonic acid and the absorption of oxygen may subsist in disease,—so that from the excess or deficiency of carbonic acid the proportion of oxygen might be inferred, but nothing seems to have been practically established in the matter.

501. Nor have any useful data been obtained concerning variations in the amount of nitrogen expired in disease.

PART II.

DISEASES OF THE LUNGS AND APPENDAGES.

SECTION I.—THORACIC PARIETES.

I.—PLEURODYNIA.

502. THE term pleurodynia, still applied in its etymological sense by some persons to all varieties of pain in the side, is now, by almost universal usage, limited to actual rheumatism of the walls of the chest, affecting their muscular (especially the intercostal) and fibrous textures. Rarely occurring simultaneously on both sides of the body, most common on the left, and in the infra-axillary and infra-mammary regions, its essential feature is pain, more or less acute, increased by the act of respiration, by coughing, by movements of the trunk, and even of the arm, and by decumbency on the affected side. Pressure both on the ribs and in the intercostal spaces is in the great majority of cases painful, sometimes acutely so. Even in the state of perfect rest, the chest-wall being by consensualism held in absolute inaction, there may be a considerable amount of pain,—probably from spasm of the muscular textures concerned. And, again, in a rare instance or two, I have known the expiration-act more painful than that of inspiration.

Pleurodynia simulates every now and then a more or less grave pulmonary seizure from the intensity of the dyspnoea attending it. Marked lividity of face has been known to ensue in the course of an hour or two in a middle-aged person free from any appreciable chronic disease of the lungs, heart, or great vessels.

In the occasional instantaneousness of the seizure, in the occasional conviction of the sufferer that he must have twisted or strained some of the parts concerned, and in the occasionally

agonizing, almost intolerable severity of the pain, there is a strong analogy between pleurodynia and lumbago. And just as in the latter affection doubt hangs over the question of the intimate site and pathological conditions of the complaint, so in pleurodynia are these points still open to debate. For my own part I cannot help thinking that nerve-fibres are implicated in both affections, and that rheumatic-neuralgia of the intercostal nerves forms an element of pleurodynia.

503. Unless co-existent with acute articular rheumatism (and, as far as I have seen, the combination is excessively unusual), pleurodynia is unaccompanied with fever.

504. *Physical signs.*—The play of the chest on the affected side in *calm* breathing is interfered with. The movements of expansion and of elevation are diminished in freedom, and their rhythm becomes jerking: in the female, as a natural result of her relatively slight inferior costal action in health [49], this is somewhat less perceptible than in the male, especially when the affection occupies its ordinary seat, —the lower regions of the chest. The natural relationship of the abdominal and costal movements in *forced* breathing becomes perverted [60, 66, 120]. The respiration-sounds are of intermittent weak type, and jerking rhythm; but, above all, there is no friction-sound to be heard. If the patient can be induced to expand the chest fully, the percussion-sound proves natural; even when the side is most inactive, it is difficult or impossible clinically to discover the altered resonance theoretically to be expected.

505. *Diagnosis.*—Pleurodynia derives much of its importance from the occasional difficulty of distinguishing it from other affections.

506. Pleurodynia closely simulates the congestive, or dry, stage of pleurisy. The presence or absence of friction-sound scarcely proves, on the onset of acute infra-mammary pain, so useful as might be anticipated in the distinction of the two affections;—for, on the one hand, friction-sound may be wanting on the invasion of pleuritic inflammation;—and, on the other, the jerking rhythm of pleurodynic respiration may so closely imitate the grazing variety of that sound, as to leave a cautious observer in doubt. Excessive suddenness of seizure, the pain having, like that of lumbago, instantly followed an abrupt movement, while the patient is not only free from actual pyrexia, but from any sense of general illness, will point very distinctly to pleurodynia. But with pain, apparently rheumatic, there may be a chance co-existence of

febrile action, cough, and slight bronchitis; the diagnosis is then extremely difficult, and a positive opinion should be refrained from, until, a certain number of hours having elapsed, the friction-sound, arising from the collision of prominent pleural capillaries or of layers of exudation-matter, if the case be one of pleurisy, will have established the fact with all attainable surety.*

The distinction from pericarditis is commonly easy,—as, were pericarditic lymph present, the inaction of the chest-wall would not interfere with the production of friction-sound.

507. The pain of pleurodynia sometimes extends so low down, as to implicate the abdominal wall, and lead to the suspicion of peritonitis. The absence of rigors and severe febrile symptoms generally, as also of vomiting, of anxious facies, and other signs of deep constitutional shock, will distinguish the former from the latter disease. In both the abdominal walls are tender to the touch; but in rheumatism, the tenderness is more superficial, and raising of the skin between the fingers more painful than in peritonitis. Besides, the thoracic pain is more strictly limited to one spot, and relatively more increased by voluntary movements, than the peritoneal.

508. The outbreak of herpes zoster is often preceded by severe pain in the side, before the slightest surface-indication of the coming eruption can be seen. The burning character of this pain is insufficient for its positive distinction. There is sometimes, however, marked cutaneous hyperaesthesia, without cough or dyspnoea, commonly with slight pyrexia, and movement is less painful (it may be painless) than in pleurodynia.

509. *Treatment.*—As a rule, pleurodynia is easily and rapidly curable; but I have known it linger on in a quasi-chronic form.

510. In plethoric people the duration of the attack may certainly be shortened by moderate cupping or leeching. Usually removal of blood is wholly uncalled for; but dry cupping may often be resorted to with advantage. The application of a large mustard poultice will sometimes afford immediate relief; if it fail (and the pain be truly severe), the hypodermic injection of morphia, or the application of the blistering fluid, followed by its endermic introduction, may be had recourse to,—especially if the breathing be interfered with. In mild attacks, friction with

* In a case seen with Dr. Neil Arnott, the diagnosis was rendered difficult by the impossibility of making a physical examination of the chest, so extensive was the tenderness. But, on the other hand, the very intensity of the pain and tenderness argued in favour of pleurodynia rather than pleurisy, and the event proved that the pleura had escaped. In this instance there was articular rheumatism also.

anodyne (especially aconite) and stimulant liniments, and the use of the warm, vapour, or hot-air bath will suffice.

Where the attack shows a disposition to linger, continued rest, combined with the use of colchicum in small, and bicarbonate of potash in full, doses, becomes an essential aid to recovery.

II.—THORACIC MYALGIA.

511. The muscles of the chest-wall, especially both pectorals, sometimes become the special seats of pain. This pain may be wholly subjective, or be a genuine hyperæsthesia, excitable by pressure, as also by manipulation of various kinds, and be accompanied with exaggeration of "muscular sense."

512. Males are more subject to this muscular pain than females, as far as I have seen. Its causes are obscure; in some persons where no exciting influence, such as over-exertion of the muscles in rowing, gymnastic exercises, *et alia similia*, can be traced, it seems dependent on a form of hysterical diathesis. In a case of this kind, some while since, under my observation,* the pain and tenderness were so constant and so great as to render application to business an impossibility.

Particular islets of the chest-wall may become the seats of chronic myalgia from persistent and constrained overuse of the muscles lying within them. One of these local varieties of the complaint is described by M. Fonssagrives † under the title of "Myalgia of embroideresses;" he places it at the inferior angle of the scapula, in the substance of the latissimus dorsi and the teres major muscles, and states that it may endure for years, become a very torture to the patient, and yield solely to the influence of prolonged rest of the parts concerned.

And, again, myalgia, apparently of rheumatic character, greatly increased by movement of the affected muscles, and accompanied with local tenderness, may recur from time to time in an individual for years.

513. Myalgia of the walls of the chest generally, or of one side of this, or of some particular muscles, may exist, while the lower extremities are paralysed to the will, the cutaneous surface of these devoid of sensation, and their muscular substance anæsthetic, though capable of being excited to contraction by direct percussion, and by reflex stimulation from the skin.‡

* E. H., Male, visiting as an out-patient, U. C. H.

† Fr. Transl. of 361 *létien* p. 220.

‡ Cozens, U. C. H., Males (Paraplegia; from acute, lapsing into chronic, softening of the cord), vol. xvi. p. 261.

514. The absence of physical signs, pleural or pulmonary, in the site of tenderness, will prevent this affection from being mistaken for any intra-thoracic disease. The pain under contraction of the muscles involved may, however, be sufficiently great to interfere with chest expansion as well as to weaken, and modify the rhythm of, the respiration-sounds.

515. Myalgia is not necessarily accompanied with cutaneous hyperæsthesia; as, conversely, the latter may exist to an exquisite degree without any muscular tenderness. Neither is there, of necessity, any "spinal irritation."

516. When myalgia has arisen from over-work of the muscles concerned, it will gradually disappear under the influence of rest. In the idiopathic hysteriform variety, nervine tonics, antispasmodics, and local anodyne applications, followed by stimulating douches, will effect a cure.

III.—INTERCOSTAL NEURALGIA.

517. The intercostal nerves are by no means an uncommon seat of neuralgia. Scarcely ever affecting both sides of the thorax (I have seen this but once), and greatly more frequent on the left than on the right side, the pain usually involves the nerves from the sixth to the ninth,—in rare instances a single trunk only.

518. The pain of this neuralgia is severe, varies in precise character, as that of similar affections elsewhere, occurs paroxysmally, follows the course of the affected nerve, or seems to pass directly backwards from the edge of the sternum to the vertebral groove, and is frequently accompanied with pain in the branches of the brachio-cephalic plexus—sometimes in the gastric filaments of the vagus.* In the intervals of the sharper pangs paræsthesiæ, such as numbness, coldness, formication, are occasionally felt.

Generally speaking, three tender points (as was first, I believe, shown by M. Valleix) may be detected by pressure in the course of the affected nerve or nerves; one in the vertebral groove, another about the axillary region, a third in front towards the terminal ramusculi. There is sometimes general cutaneous hyperæsthesia in the region implicated, and gradual but firm pressure over a broad surface gives relief.

519. The physical signs are the same as those of pleurodynia:

* Benson, U. C. H., *Females*, vol. viii. p. 225, Martin, U. C. H., *Females*, vol. ix p. 120.

impaired thoracic movement, with weak jerking respiration,—the percussion-signs being negative.

520. Hysterical and anæmic women are the most frequent subjects of this neuralgia; it is not by any means a constant attendant on spinal irritation. Not unoften mammary neuralgia supervenes as a sort of further development of the affection: * and then local lobular swelling either takes place in the gland, leading to a form of chronic simple induration; or, as I have more than once seen (illustrating the old principle, *ubi dolor, ibi fluxus*), suppuration may actually ensue. The obstinate pain, which sometimes occurs as a sequence of herpes zoster, seems to be an intercostal neuralgia. †

521. The complaint derives its interest, in respect of pulmonary pathology, from the possibility of its being taken for an evidence of pleurisy, and from its being pretty frequently associated with phthisis. In anginal and pseudo-anginal affections of the heart this form of neuralgia sometimes plays a subsidiary part of no mean importance.

522. The three painful spots in the course of the nerve indicate the true nature of the disease, distinguishing it from pleurodynia, myalgia, costal periosteitis, and all pains of intra-thoracic origin. But these three points are not always to be found, when on other grounds (especially the impossibility of explaining the patient's sufferings in any other way) the case might fairly be judged to be one of intercostal neuralgia. Sometimes they become clearly evident after the lapse of a day or two,—in other cases they never distinctly appear, and the diagnosis remains to the end unsatisfactory. Still I do not think we are called upon to deny the existence of this neuralgia on the single ground that the tender spots in question fail to the end to reveal themselves.

523. The *prognosis* is uncertain as to duration, relapse, and recurrence: in my experience both the latter events have been common. Months may wear away, before cure is solidly established. The anæmic form is the most easily got rid of.

524. *Treatment*.—If the tenderness be extreme at any one of the three points referred to, a few leeches are requisite; subsequently flying blisters, will, as concerns local measures, be suffi-

* Benyon, U. C. H., *Females*, vol. viii. p. 225.

† I have known this pain resist every conceivable remedy for upwards of three months, and profoundly affect the general health. Admitting it to be an intercostal neuralgia (an idea, however, not unopen to objection), what is the mechanism of this? Romberg's suggestion, tracing it to morbid changes in the blood vessels of the intervertebral foramina influencing the contiguous nerves, seems to me rather fanciful than satisfactory.

cient. But sometimes, after a sharp attack, a minor amount of pain recurs from time to time, which is best relieved by the endermic use of morphia, or by inunction with ointments containing belladonna or aconite, or in severer cases their alkaloids.

The internal treatment will vary according to circumstances. If the neuralgia appear a mere subsidiary phenomenon of phthisis, there is no necessity for altering the treatment designed for the main affection; if, on the contrary, it become for the time the dominant source of suffering, quinine, arsenic, and iron, combined with purgatives, are, as in the case of other neuralgia, advisable. If it be associated with a distinct diathesis, the specific treatment for this must be adopted.

IV.—INTERCOSTAL NEURITIS.

525. Inflammation of the intercostal nerves, with vascular injection, and considerable enlargement of their substance, has been described by M. Beau, as an attendant on pleurisy both in its acute idiopathic, and chronic tuberculous forms. The pleuritic "stitch in the side" he looks upon as the result of such neuritis. That "stitch" may have existed without anatomical evidences of neuritis being detected after death, is indubitable, but it cannot be affirmed they have always been looked for with all necessary care. M. Beau's suggestion most certainly deserves closer investigation than it has received, for the intimate nature of pleuritic pain remains to the present day a mystery [788].

V.—VARIOUS PARIETAL DISEASES.

526. A number of affections of the walls of the chest produce physical signs that might, without due caution, be confounded with those of intra-thoracic diseases. A mere reference to some of them,—such as may serve to put the physician on his guard—is all that can be ventured on here.

527. Thus costal periosteitis (whether of rheumatism or tertiary syphilis*) with its tenderness, local percussion-dulness, and somewhat weakened subjacent respiration, might very readily be mistaken, at the apex of the chest, for consolidating pulmonary disease beneath, unless the ribs were carefully examined. Carcinomatous infiltration of a rib, especially if there be no external prominence, may in like manner deceive.† Abscess of the

* Morse, U. C. H., Females, vol. x. p. 152.

† Jennings, U. C. H., Females, vol. xv. p. 65. I have seen two contiguous ribs united in this manner.

sternum,* or situated between the periosteum and the anterior,† or at the posterior,‡ surface of that bone, may simulate, according to its precise site and characters, mediastinal abscess or tumor, or aortic aneurism. Subcutaneous emphysema and anasarca sometimes give rise, through the movements of respiration, to rhonchoid noises simulative of true bubbling rhonchus and friction-sound.

SECTION II.—THE DIAPHRAGM.

528. It would seem that diseases of the diaphragm must be rare; else a structure playing so important a part in the physiology of respiration could hardly have met with such scant notice, as it has actually done, at the hands of writers on chest diseases. But I am persuaded much of their silence depends less on the actual immunity from disease of the musculo-fibrous septum, than upon the rarity with which it is examined *post mortem*. Clinical ignorance is the necessary result of this neglect. I can do little more than offer an outline to be filled in by others.

I.—DISPLACEMENTS.

529. First let us consider the position of the septum in respect of the thoracic walls, both in health and disease.

In calm breathing the highest part of the arch of the diaphragm in the adult slightly oscillates upwards and downwards on the level of the fourth interspace on the right side, that of the fifth rib on the left, while the central tendon lies a little lower than this. The right side of the chest is consequently somewhat shallower than the left,—the want of depth below being by no means always counterbalanced by greater height above [8]. In children the entire floor of the chest lies very slightly lower than in the adult. Full eating, and flatulent distention of the abdomen, temporarily raise it somewhat. The influence of tight-lacing in the female will vary with the fashion of the day: if the waist be "worn high," the constriction will depress, if "low," will raise, the diaphragm.

The position of the right wing is ascertainable by percussion of the liver anteriorly; where the sound becomes grave and of pulmonary quality on forcible percussion, carried from below upwards, lies the upper border of the liver, and by inference, the

* Reilly, U. C. H., *Males*, vol. vii. p. 305.

† Mattlee, U. C. H., *Females*, vol. v. p. 36.

‡ Buckley, U. C. H., *Males*, vol. ix. p. 248, 340.

convexity of the arch of the diaphragm. The cessation of vocal fremitus, where the liver is uncovered by lung, will corroborate the results of percussion, and supply a measure of the depth of liver overlapped by lung. The main guide to the position of the left wing will then be the fact that in health it always lies a little lower than its fellow; while the position of the heart's apex and the special resonance of the stomach will afford corroborative evidence. It has, besides, been shown by Edwin Harrison, that the exact situation of the vault of the diaphragm may, in many cases, be rapidly determined by inspection and application of the hand. The mode of proceeding varies according to the shape of the thorax, which is, with reference to this investigation, of two kinds:—1. If the width of the chest be greater just above, than precisely on, the level of a line drawn transversely across from the lower part of the ensiform cartilage—in other words, if a slight lateral depression correspond pretty accurately to that level—a very simple method is described by this observer for discovering the position of the upper edge of the diaphragm. Let the hand be passed from below upwards along the side of the chest, with its inner edge kept closely to the surface and the palm somewhat everted, and that inner edge will sink into a narrow sulcus situated somewhat higher up than the lateral bulge just referred to. This sulcus, which may or may not be on the same level on both sides, indicates the precise height of, and corresponds to, the vault of the diaphragm. 2. If the width of the chest be less immediately above, than on the level of, the ensiform cartilage, this rule will not apply: however, the position of the left half of the septum may then be detected by the beat of the apex of the heart; and the right half is at least not lower than its fellow. In the main these guides are correct; but exceptions occur. Thus age, by enlarging the bulk of the lung through distended atrophy, or by diminishing that bulk through simple atrophy without distention, changes the position of the wings of the diaphragm, without affecting that of Harrison's sulcus. The sulcus is impressed on the side in youth, and remains unaltered in age. So, too, I have found that, where prolonged tight-lacing had displaced the liver and diaphragm, the sulcus had, for the same reason, ceased to correspond with the upper part of the arch.

530. In *disease* the wings of the diaphragm may be both raised; both depressed; or one only may be depressed or raised, its fellow remaining *in statu quo*; or one may be raised and the other depressed; or the central tendon may be specially depressed.

In order to determine with precision the nature and amount of disease effecting these changes, I have been in the habit for some time of noting the position in the dead body of both wings of the diaphragm, before the chest is opened, and find in my hospital-books thirty-three cases proper for analysis in this point of view. The highest position observed in the series was the second intercostal space,—the lowest, three inches below the false ribs; the relative frequency with which the arches reached different heights of the thorax was as follows :—*

	Right.	Left
Second space	1	1
Third rib	—	—
Third space	8	1
Fourth rib	7	5
Fourth space	8	4
Fifth rib	6	13
Fifth space	1	7
Sixth rib	1	1
Below false ribs	1	1
	<hr/> 33	<hr/> 33

Hence it appears that in three-fourths of the cases the right vault lay *above* the fifth rib, while in two-thirds of the whole the left lay *opposite* or below it; and further, that the right wing in disease most commonly lies between the third interspace and fifth rib (in $\frac{3}{4}$ of the cases); whereas the habitual range of the left wing is from the fourth rib to the fifth interspace (in $\frac{3}{4}$ of the cases).

Next, setting aside two cases of empyema, and one of ascites, I find that the right wing lay higher than the left in twenty-one persons; the left higher than the right in two; while both were on the same level in seven. Excluding the same three cases, the amounts of difference between the heights of the two wings varied thus :—

	Right wing, above left.	Left wing, above right.
By half a rib or space	12	2
By a rib or space	5	
By a rib and a space	3	
By two ribs and a space, or two spaces and a rib	1	

Hence in nearly half the instances, where the right wing lies higher than the left, the excess of elevation only amounts to about half an inch.

531. But what are the morbid conditions connected with these

* It is to be remembered, that after death the collapse of the lungs draws the diaphragm slightly, but very slightly, upwards.

variations in the position of the diaphragm? The case of elevation to the second interspace was one of enormous ovarian and ascitic accumulation of old standing; both wings were equally raised: those of great depression (the diaphragm being highly convex downwards) were examples of profuse pleural accumulation, solid and fluid, and fluid and gaseous. These are the kinds of affection which seriously modify the position of the septum. A case, where both arches lay opposite the sixth rib, was one of vesicular emphysema, uncomplicated with any other change of consequence. In the other cases a variety of conditions existed of opposing tendency; but a fair consideration of all leads to the conclusions—that rarefying diseases of the lung mechanically depress the diaphragm on one or both sides; that chronic condensing, because contracting, diseases raise it by a force of suction; that pleuritic adhesions, considered independently, have rather a depressing influence than otherwise: and lastly, that the discovery during life of any disease, even if it be highly marked, which tends *per se* to modify the position of the diaphragm, does not justify the assumption that it has so modified it in the particular case; for some counteracting, though less obvious, influence may be at play.

Now it follows from the last proposition, that the position of the arches of the diaphragm in disease can only be ascertained by direct observation. Harrison's sulcus, remaining as it does a fixture, tends to deceive rather than enlighten; and, though the possibility of such effect, in cases of old-standing disease, is conceivable, I have never actually found a *new* sulcus corresponding to the altered site of the diaphragm. The vocal fremitus and the results of percussion are in truth the only real and trustworthy guides to the plane of union of the chest and abdomen.

Extensive double emphysema, pericarditic effusion, and hypertrophy of the heart, lower the central tendon.

II.—PARALYSIS.

532. "Paralysis of the diaphragm is incompatible with the duration of life, and can only occur during the last moments of existence." Such was the common professional doctrine at the time Copland wrote these words.* Somewhat earlier, however, Dr. Stokes ascribed to paralysis of the diaphragm "the depression of the abdominal viscera," "accompanying the advanced stages

* Dictionary of Med., vol. i., p. 54, 1837.

of pleuritic effusion.* To M. Duchenne† belongs the credit of having clearly proved that life may hold on without serious disturbance, so long as the accessory muscles of respiration and the lungs remain unaffected, though the diaphragm be, as matter of demonstration, completely paralysed.

533. *Symptoms.*—In the state of repose little or no inconvenience appears to be experienced in cases of paralysed diaphragm, when there are no associated conditions to cause distress. There is no striking quickening of the respiration, though some increase of frequency usually exists. If effort of any kind be made, a more or less marked sense of oppression and respiratory distress is complained of. Habitually some slight uneasiness exists at the epigastrium and costal angles, and sometimes in the hypochondria.

Dysphonia of a peculiar kind seems inseparable from the affection. In the morning the voice may be pretty natural in strength and quality; as the weariness of the advancing day increases, so does the voice lose in power, till reduced to a cracked whisper. There must always be a tendency towards collapse of the lungs, and the aphonia would be explicable like that of *Algide cholera* by imperfect air-current through the larynx.

The pulse-respiration ratio, habitually perverted, may stand at 2·5 : 1.

The appetite may be good, the sleep unaffected. The acts of micturition and defecation are not sensibly impeded, but strong effort would, of course, be impossible.

534. *Physical signs.*—The elevation-movements of the chest are more marked than the expansile class. In ordinary breathing no particular movement is noticeable below the costal margin; but, if a deep inspiration be taken, the epigastrium and hypochondria sink in, recovering their previous positions in expiration [60].

Although the amount of tidal air must range below par, the decrease is insufficient to modify sensibly the natural type of percussion-sound. The audible characters of the respiration remain free from noteworthy alteration.

535. *Conditions of origin.*—Paralysis of the diaphragm has been noticed in hysterical women; but it is vastly less common in them than the converse state of clonic spasm: under these circumstances it is purely nervous. In saturnism the mechanism is the same as that of the paralysis of the extensors in a dropped wrist. It seems to be one of the final developments of progressive muscular

* Dub. Journal, Med. Sc. 1836; also Dis. of the Chest, p. 463, 1837.

† L'Electrisation localisee, 1855

atrophy, and may sometimes be traced to fatty metamorphosis of the fibres of the muscle. Paralysis also accompanies inflammation of the proper muscular structure and occasionally that of its pleural and peritoneal coverings.

I have seen it take a well marked place among the sequential paralyses of diphtheria.

Paralytic weakness may attend rheumatism of the diaphragm.*

536. *Diagnosis*.—The diagnosis turns wholly upon the detection of M. Duchenne's two signs: the perverted respiration-movement of the upper abdominal wall and the peculiar aphonia.

Whether the paralysis is purely dynamic, or arises from structural change, may be determined by galvanizing the phrenic nerves: sharp contraction will follow in the former, little or none in the latter, cases.

537. *Prognosis*.—The purely dynamic form of the disease may disappear spontaneously as it came; or it may yield to treatment. The saturnine variety will disappear on the elimination of all lead from the system through iodide of potassium, or otherwise. The graver structural forms are, of course, incurable.

538. *Treatment*.—Nuxvomica and iron are worth trial in the nervous class of cases in association with asafoetida in large doses.

In employing the obvious remedy, the galvanic current, care should be taken not to use it too strong at first; and it might be advisable to interrupt the flow at rhythmic intervals, so that the electric impetus should synchronise with the time of inspiration.

III.—HYPERÆSTHESIA.

538.* The exquisitely painful sensation which attends violent and uncontrollable laughter is evidently seated in the diaphragm. The additional suffering in pleurisy and pericarditis, where the phrenic portion of the pleural membrane is involved, is clinically a familiar fact. Besides, in many cases of painful sensation of stitch-like character below the nipple on the left side, there appears motive for believing that the real seat of pain is in the diaphragm.

IV.—SPASM.

539. Hiccup is the familiar name for a noisy inspiration-sound, produced mainly in the larynx, but reinforced in the fauces and posterior nares, accompanying an abrupt uncontrollable contraction of the diaphragm,—sometimes repeated two or three times,

* Foussgrives, *op. cit.* p. 28.

before expiration follows. The hiccup may return at intervals of a minute or two,—or within moments so short, that respiration may be temporarily impeded.

540. Uneasiness at the epigastrium, by-and-by accompanied with aching pain in the line of insertion of both wings and the crura, which may eventually acquire great severity: such appear to be the only necessarily co-existent symptoms.

The force of the phrenic contraction may be very slight, or sufficiently strong to give a distinct slap to the hand placed in the hypochondrium, or to shake the entire trunk and even the bed on which the patient lies. In severe cases slight tetanic rigidity of the muscles of the neck may occur.

The laryngeal noise may be scarcely audible, or be so loud as to be heard the entire length of a long ward.*

541. Although the diaphragm is the essential seat of the spasmodic respiratory act described, morbid states of its own substance or its investing serous membranes are not its common causes. Phrenic pleurisy is but rarely attended with hiccup. The phrenic nerves, as I have frequently seen, may be pressed against and displaced by mediastinal tumors (it is to be assumed with irritative influence) without any of these spasms following. The diaphragm may be pushed up also to the second interspace and down to the level of the umbilicus without any such result.

The really active cause is reflex irritation. The starting point of the excitant may be in the pharynx, the œsophagus, stomach, intestines (worms, &c.), the liver, or pancreas. The passage of gall stones or of a renal calculus sometimes produces the spasm. Spinal irritation, utero-ovarian excitement and hysteria are perhaps the principal causes of its graver forms. Injuries and diseases of the brain, medulla oblongata and cord sometimes induce it, and it has played the part of the warning symptom in the epileptic fit.†

Imitation, among hysterical women, readily sets it up.

542. Hiccup may cease in a few minutes, or it may last steadily for months, holding on even during sleep and producing excessive exhaustion in cases of this class. I have more than once known it actually jeopardize life. Hiccup occurs in all kinds of grave diseases towards their close, and may often be accepted as a very significant sign of speedy dissolution.

543. In the treatment of persistent hiccup the essential object should be to attack the first link in the reflex chain. One illus-

* Spencer, U. C. H., Females.

† Olivier, *Morile Equine*, 6d. 3, p. 778.

tration will suffice: I once succeeded in removing hiccup of three weeks' duration by the application of a blister to each ovarian region.

But in cases purely hysterical, or when the mechanism is unintelligible, more empirical measures must be had resort to. Dry cupping of the hypochondria, anodyne and stimulant liniments to the spine and base of the chest; galvanization from the nucha to the insertion of the diaphragm; hypodermic injection of morphia at the epigastrium may all be tried. I have found blisters in the line of each phrenic nerve in the neck distinctly serviceable.

Internally opium, anti-spasmodics of all kinds, especially *assa-fetida*, musk, and belladonna, are chiefly to be relied upon. Occasionally inhalation of chloroform stops the paroxysm at once; but it recurs: this is true also of the effects of hydrate of chloral. In protracted cases the bromide of potassium in full doses becomes an advisable remedy.

Hippocrates noticed that a fit of sneezing would stop hiccup: sternutatories should be tried. A strong impression on the nerves of any kind will sometimes put an end to the spasm: dashing cold water on the surface, or drinking largely of iced water. Acting on the emotions by fright or surprise has sometimes succeeded.

V.—DIAPHRAGMATIS.

544. Inflammation of the actual structure of the diaphragm, under all circumstances rare, has never fallen under my notice except in association with, and apparently as a sequence of, inflammation of adjacent structures, especially the pleura and peritonæum.

545. Red, patchy, and ecchymotic discoloration of the muscular fasciculi; softening of these and of the central tendon; infiltration of the connective tissue, serous, exudative and purulent: all this I have seen. Ulceration and gangrene are said also to occur.

546. Are there any specific symptoms (added to those common to grave internal inflammations) pointing authoritatively to the diaphragm as the seat of the disease? Burning, constrictive pain in the site of the septum extending into the loins, increased by all forced respiration-acts, by movements of the trunk, and by pressure at the epigastrium,—painful dysphagia,—sighing or hiccup,—contraction of the facial muscles, especially at the angles of the mouth (*risus sardonius*),—and violent delirium are said to be very distinctive. Doubtless, too, they are so, when combined. But the most apparently significant, for instance, hiccup [541],

may be wanting. Defecation is painful, hence increase of the constipation appertaining to the disease in its acute character.

It seems probable that inflammation originating in the diaphragm, or travelling to the muscle from its investing membranes, may end by involving adjoining structures of importance. Abscess under the septum, at least, spreading to the muscular substance, may reach the pericardium and set up fatal inflammation there.*

547. The physical signs have yet to be worked out clinically. Short, frequent intercostal breathing has been noticed,—as, likewise, falling in of the hypochondria.† The latter observation is, doubtless, an imperfect description of Duchenne's sign, the presence of which is evidently to be expected.

548. If the physician felt clearly satisfied of the existence of diaphragmitis, it is not evident that the treatment of the case could be otherwise than simply antiphlogistic.

VI.—FATTY METAMORPHOSIS.

549. An original and valuable contribution by Mr. G. W. Callender,‡ of six well-marked examples of this form of disease, furnishes the following conclusions on analysis.

550. The portions of the muscle nearest the central tendon seem to suffer the earliest; the crura remaining natural to the last in two-thirds of the cases. Both wings of the muscle suffer equally. The tissue of the muscle looked pale and mottled, even through the peritonæum; its fibres were fragile; microscopically fat-granules were found to have displaced the sarcois structure.

The body generally was more or less loaded with fat,—or the peritonæum only,—or general and well-marked emaciation existed.

In all but one of the cases (and there its absence is not affirmed) fatty degeneration of the heart's fibre was present. The liver and arteries were also fatily diseased in some instances. The voluntary muscles had remained unchanged in texture.

In three cases the lungs were tuberculous; chronic and acute cardiac disease, dilatation and endo-pericarditis, existed in two others.

551. Four females ranged in age from twenty-two to fifty-nine; two males were fifty-two and fifty-three years old.

552. These cases were not observed by Mr. Callender during

* Crawley, U. C. H. Females, vol. x. p. 19.

† Repaultin, Dict. des Sc. Méd., vol. ix. 1819.

‡ Lancet, vol. i. p. 39, 1867.

life: precise clinical information is wholly wanting concerning them. It would seem, however, that dyspnoea, habitual and subject to sudden aggravations, orthopnoea with lividity and cold clamminess of surface, sudden and great depression as if from shock, may be looked for, at least towards the close of the disease. The respiration, hurried, shallow, and wholly thoracic, while the abdomen remains either fixed and motionless or contracted and rigid, gives something of a distinctive character to the symptomatology.

The constant, or well-nigh constant, co-existence of fatty wasting of the heart must greatly increase the intrinsic difficulties in the diagnosis of this affection. In the mass of cases the breathing, it is true, remains free from serious implication in the cardiac disease,—orthopnoea certainly does not belong to that affection in any fashion. Can it be that the peculiar forms of perverted breathing-rhythm, noticeable in occasional cases of fattily-wasted heart, have really a dependance, complete or partial, on associated metamorphosis of the chief breathing-muscle; the difficulty of explaining those forms of perversion has always been admitted. Be this as it may, the diagnosis of the phrenic disease is evidently a question of the future and of physical signs alone.

VII.—DRAWNT INDURATION.

552*. The terrible dyspnoea, which sometimes forms one of the features of the closing scenes in scurvy, seems traceable to brawny induration of the diaphragm, identical in nature with that occurring in the voluntary muscles (Perrin, *Union Médicale*, 1857). This dyspnoea is wholly different from the minor distress of breathing, caused by the blood-alterations in the disease.

VIII.—PROGRESSIVE MUSCULAR ATROPHY.

553. The diaphragm is one of the very last muscles reached by this terrible form of atrophous destruction,—even the intercostal planes wasting before it. In 7 only out of 105 cases tabulated by Dr. Roberts, does the diaphragm appear to have been distinctly affected; * it must be remembered, however, that in the vast majority of the series, the disease, when last under observation, was far from having reached its ultimate term.

554. Atrophous destruction associated with fatty streakiness characterises the disease here, as in the voluntary muscles.

* On Wasting Palsy, 1858.

555. Information concerning the symptoms is very defective. Tightness of chest is sometimes experienced at an early period. When the intercostals are paralysed, if the respiration be actively abdominal, the escape of the diaphragm may be considered so far certain,—especially if the rhythmic relation of its movements to the ingress and egress of air from the lungs continue normal. In proportion as its fibres waste, there will doubtless follow an increasing amount of the perverted rhythm and movement described by Duchenne [60]. Suffocating fits of coughing occur;—commonly, it would appear, bronchial muco-serous fluid accumulates as a terminal occurrence; and, as all expulsive power is lost, death by asphyxia is then not slow in releasing the sufferer.

556. It seems almost absurd to advert to the treatment of a state which is habitually the final term of evolution of such a disease as progressive muscular atrophy. But there is no certainty that destruction of the phrenic fibres may not sometimes commence earlier than has hitherto been supposed. If the least ground arose in any case for such an opinion, galvanism (which in the special form of Faradisation has produced remarkable results in the hands of Duchenne on the external muscles)* ought to be immediately and steadily employed.

IX.—MORBID PRODUCTS.

557. Morbid products of various kinds have been found in the actual connective tissue of the diaphragm; but their clinical history is at the present an absolute blank.

In fact, too, it is unlikely, unless the new formation acquire very considerable bulk, that special symptoms would occur. In an interesting case, where a syphilomatous mass, the size of a plum, occupied the fleshy part of the diaphragm, no special effect appears to have been noted during life.†

X.—PERFORATION.

558. Although perforation of the diaphragm is by no means of uncommon occurrence, the symptoms and signs, it immediately and directly originates, are at the present day unknown: they are habitually lost sight of amid the more readily distinguishable evidences of co-existent occurrences.

559. The diaphragm may be perforated (a) from below upwards,

* *Electrisation locale*

† *Moxon, Guy's Reports, p. 461, 1868.*

or *2*) from above downwards: the latter variety is relatively very rare.

(*a*) An abscess of the liver on its way to the pleural sac, to the lung-substance, or to the interior of the pericardium; an abscess in the spleen emptying itself above; pyelitic fluid conveyed from the renal pelvis through the septum and expectorated: all leave the marks of exudative inflammation in the serous membranes concerned; but the state of the muscular tissue seems to have been forgotten in post-mortem records. So, too, in those rare cases where a simple chronic ulcer of the stomach has, after adhesion, eaten its way through the diaphragm, few, if any, particulars of the state of the sarcoous structure have been registered.

(*b*) Abscess of the lower lobe of the lung; empyema; and aneurism of the thoracic aorta, appear as observed causes of perforation acting from above.

560. What the passing, as also the more persistent, influences of the perforation might be upon the respiration-play of the diaphragm, remains to be discovered.

XI.—RUPTURE.

561. Rupture of the diaphragm may occur either through the muscular substance of either wing, through the central tendon, or, more rarely, through the crura; or the septum may be torn from the ribs and sternum.

562. The observed causes have been: violent blows on the back, hypochondrium, and epigastrium; falls from a certain height; violent efforts, as of continued retching, of parturition, &c.; and the effort to conceal or suppress the cries of pain.*

563. The immediate symptoms are those signifying grave collapse from internal injury: as a general fact the sufferer rapidly perishes,—*risus sardonius* sometimes giving a distinctive character to the death-struggle.

But the occurrence is not necessarily fatal at once; nor need it, or its specific result, directly shorten life,—as will by-and-by be shown.

This specific result is hernia of a portion of the contents of the abdomen into the chest,—the account of which condition will supplement this article.

* In parturition, *Dict. des Sc. Méd.* ix., 217.

XII.—DIAPHRAGMATIC HERNIA.

564. Hernia of the contents of the abdomen into the chest may be a congenital defect or an acquired lesion.

In such cases *congenital* openings in the diaphragm have been formed either in spots not naturally perforated, or they have been caused by widening of the œsophageal or vena cava canals.

Of the *acquired* variety the observed causes have been gunshot and other wounds; rupture produced in the various ways previously set down [562]; and, in very rare instances, perforation by disease.

565. Whatever be the nature of the opening, the contraction of the walls of the abdomen is clearly the essential dynamic cause of the escape of its contained viscera into the chest.

566. In congenital cases as many as four openings have been found in the same individual; a portion of intestine passing in at one, and out at another, spot.

In cases of rupture the opening has almost always been single; in form straight, lunated, conical, or ragged and shapeless;—in size reaching a length of seven or eight inches in some instances.

567. If the occurrence do not prove fatal at once, the opening contracts,—and may not, at the end of eight months, exceed a third of an inch in diameter, though still giving passage to a portion of the colon. The shape of the opening generally becomes oval,—the edges thickened, hardened, and rounded smoothly off: occasionally some of the abdominal viscera adhere to the borders.

568. The parts which most commonly escape into the chest are the stomach and colon; these may be followed by (never, as far as I know, preceded by) the omentum, coils of small intestine and the spleen.

569. The left side of the chest has always, as might be expected, proved the seat of the hernia.

570. *Symptoms*.—(a) The symptoms at the time of the occurrence are those of rupture of the septum [563].

(b) Where life is not destroyed at the moment, the patient may gradually recover strength, and labouring men have, in rare instances been known to carry on their daily toil without very much distress.

Habitually, however, there is frequent tormenting cough, dyspnoea under the least exertion, pain in the chest, and constantly recurring syncopal tendency.

In the digestive organs colicky pains, and indescribable forms

of uneasiness, with more or less grave constipation and daily vomiting, are noticed,—the latter symptom no doubt depending on the twisting upwards of the œsophagus through the raised position of the cardiac orifice of the stomach.

571. *Physical Signs*.—Flattening of the abdomen and distension of the chest inferiorly, to a degree proportional to the quantity of viscera carried from the former into the latter cavity, have frequently been noticed even by early observers.

No trustworthy description exists of the perversions of respiration-movements that must, as a physical necessity, arise.

The percussion-note, habitually rather amphoric than tympanitic from the displaced stomach or colon, may be of the toneless type, from the presence of the spleen. Of the note furnished by the elevated and condensed lung below the clavicle, I know nothing but by conjecture [219].

Respiration-sound will be audible along the spine and in the upper part of the lung. In the site of displaced hollow viscera there will be either dead silence or the noises depending on movement of flatus and fluid within them. The sound of fluid, entering the displaced stomach, may be better heard within the area of the chest than below the natural level of the diaphragm.

The lung is driven upwards; the heart and mediastinum towards the opposite side,—the heart may, however, be pushed rather upwards than sideways.

572. *Diagnosis*.—(a) *Risus sardonicus* has sometimes been noticed at the time of rupture, and given a sort of stamp to the nature of the injury causing the grave collapse present.

(b). But at later periods this guide will of course be wanting.

From *pneumothorax* hernia will be distinguished by the abdominal flattening; by the quality of chest-note being amphoric not tympanitic; by the absence of intercostal distension; by the non-appearance of pleuritic effusion; by the gurgling stomach-sounds produced within the thorax, when any fluid is swallowed; possibly by the heart, if the rupture be seated towards the middle line, being pushed upwards and not to the right side.

From *emphysema*, carried to an extreme amount, hernia through the diaphragm will be sufficiently distinguished by the position of the heart,—which in such emphysema would be notably lower than natural.

A greatly distended state of the colon, with upward displacement of the left wing of the diaphragm, paralysed by the nervous shock of a grave injury, might simulate phrenic rupture with sequential

hernia. The absence of abdominal flattening could scarcely be trusted to as positive evidence of mere distension of the colon. In a remarkable case, seen with Mr. Solly and Dr. Pavy, some considerable time after the patient had had a terrific fall, the perfection of recovery seemed to show that the displacement of the heart and lung, originally noticed, must have depended rather upon such colonic distension than upon actual hernia.

573. *Treatment*.—In an event of this kind, ascertained just after its occurrence, would it, asks Laennec, be justifiable to make an incision into the abdomen and draw back the intestines?

SECTION III.—BRONCHIAL TUBES.

I.—INFLAMMATION.

574. Inflammation of the bronchial tubes, or bronchitis, the most common of pulmonary diseases, occurs, idiopathically, in the acute and chronic forms.

(1.) ACUTE BRONCHITIS.

575. Clinically, as well as pathologically, acute bronchitis differs so materially, according as the disease implicates merely the larger and medium-sized tubes, or involves the capillary ramifications and confines of the alveoli, that the two varieties must be separately considered.

A.—*Bronchitis of the Larger and Medium-sized Tubes.*

576. This variety of the disease is anatomically characterised by injection of the mucous membrane, capilliform generally, maculated occasionally, and rarely visible to the naked eye beyond the third or fourth divisions. Commonly strips of the membrane of good length, say, from half to three-quarters of an inch long, may be separated by careful manipulation; but in rare instances they are short from slight softening. The membrane is in exceptional cases thickened, and still more exceptionally the sub-mucous tissue infiltrated with soft exudation-matter. Epithelial desquamation occurs in patches: true ulceration never. The form of the tubes is unaltered: they contain aerated mucus, exudation-matter non-moulded,* pus and epithelium,—the whole free from blood. The pulmonary tissue is natural. Such changes as exist equally affect the tubes of both lungs.

577. The *incision* of the disease is commonly marked by coryza,

* Rymes, U. C. H., *Males*, vol. xi. p. 157, Nov. 1854, —Chronic and acute phthisis with general bronchitis.

sore throat, and slight hoarseness, chilliness, scarcely amounting to rigors, with lassitude, aching pains in the limbs, and frequent pulse. The occurrence of coryza is significant of the primary character of the disease,—tuberculous bronchitis very rarely originates with this form of flux.

578. *Symptoms.*—The pyrexial symptoms may either precede, or closely follow on, the appearance of local disturbance; in the former, they are as a rule more severe than in the latter, case. The temperature may, however, scarcely rise above the par-variations of health.

The disease being established, more or less discomfort and pain are felt behind the sternum,—a sensation of heat, soreness, or rawness of the bronchial surfaces, increased, perhaps, to acute pain by coughing, and attended with a consciousness of oppressed breathing. The respiration is increased in frequency, slightly out of proportion with the pulse,—in severe cases, notably so. The cough, an essential feature of the disease, at first short and dry, or nearly so, is loud, hoarse, and ringing, occasionally paroxysmal, and severest after sleep. After the lapse of one or two days, when it becomes loose, it is attended with expectoration of frothy mucus, watery in the main, ropy in some measure, of saline taste, faintly yellowish, yellowish green, or grayish yellow in colour, free from blood visible to the naked eye, varying greatly in quantity, and gradually becoming muco-purulent. The sputa run together into a single mass, except in rare instances, when they assume the nummulated form, with perfect opacity: I have seen this, even in children, in the bronchitis of measles. Referred sometimes, by the patient, to the sternal region, the cough is more frequently brought on by a tickling feel about the trachea and larynx, where the sufferer will consequently obstinately contend his whole ailment lies.

Microscopically, the clear sputa of bronchitis consist of hyaline fluid, mucus-corpuscles, and small-sized tessellated, cylindrical, and ciliated epithelium; the opaque variety, of exudation-cells and masses, epithelium, pus-cells, and some rare blood-discs. Saliva and epithelium from the mouth are accidental admixtures.

The quantity of epithelium found in the frothy fluid in the tubes after death is always greater than in the sputa during life; in accordance with the general law of desquamating diseases, of which perhaps the most remarkable example is furnished by the greatly less proportion of separated epithelium contained in the alvine discharges of Asiatic cholera during life, than in the contents of the bowel after death.

The urine is of febrile type; * the existence of any particular heat in micturition (pointing to the co-existence of vesical catarrh), or of seminal emissions, as referred to by Lænnec, has not pressed itself on my attention.

579. *Terminations.*—Lasting from four or five days to two or three weeks in cases of complete recovery—and these constitute the vast majority,—attended with pyrexia of sthenic or asthenic type, the acute disease may besides terminate in its chronic form, or actually prove fatal. The variable length of the attack in the first class of cases depends sometimes on the extent of surface involved; probably sometimes on the depth to which the disease reaches in the bronchial walls; but also not unfrequently on the existing diathetic state, inasmuch as with the same general and physical signs, and under the same treatment, cases vary pretty widely in their duration. The chronic disease supervenes more especially, where the deep tissues of the tubes are involved by the acute attack.

580. Death, solely occurring in infants, in aged persons, and in those constitutionally debilitated by excesses, injuries, or disease, is even in these classes excessively rare; acute bronchitis, really destructive of life, belongs to the next variety.

B. — General and Capillary Bronchitis.
(olim *Peripneumonia Notha.*)

581. *Anatomical Characters.*—Even in this variety of the disease the proper tissue of the minor and capillary tubes suffers less than that of the larger: still, redness, irregular thickening, and in some cases softening, in yet rarer ulcerations, or at least deep abrasions (possibly a distinction without a difference) may be detected with the naked eye in the smallest bronchi thus traceable. The tubes are very generally dilated uniformly, or more rarely unevenly; they contain even to their very extremities mucopus, thin and fluid or lumpily inspissated, sometimes actual exudation-matter, more or less closely adherent,—the latter in the form of casts, never of any great length, and either solid or tubular.

The lungs, extensively or even generally air-distended, are sometimes acutely emphysematous; hence general excess of bulk. But here and there the surface is depressed in the sight of collapsed lobules, or irregular islets of lung, airless and quasi-solid,

* Water and urea decreased, uric acid increased.

yet capable of insufflation from the trachea, unless the inspissated mucus-pus or exudation-matter in the communicating tubes be very abundant. True pneumonia, lobular or diffused, is of purely exceptional occurrence; * the parenchyma is often even unusually pale. Minute accumulations of pus, looking intra-parenchymatous, but really traceable to the interior of the alveoli and ultimate tubes, are sometimes found towards the surface of the lung.† The bronchial glands are often inflamed,—injected, large and soft.

582. The *causes* of idiopathic capillary bronchitis are essentially the same as those of the less severe variety,—exposure to extreme absolute cold, or sudden transition from a heated to a relatively cold atmosphere. Why some persons should have the grave, others the mild disease is unexplained. I have not been able to trace the former to any diathetic influence. Capillary bronchitis is most common in infancy and childhood, next most frequent in old age, rarest in young adults.

583. *Symptoms*.—Capillary bronchitis being generally preceded by inflammation of the larger tubes, the symptoms of invasion are not so decided and severe as might otherwise be expected. Rigors are rare; vomiting rarer. Still the capillary tubes may suddenly become involved, even after a lull of symptoms of the milder disease; and though even under these circumstances the rigors of an acute seizure may be wanting, the severity of the general symptoms from the first shows the gravity of the attack. On the other hand, I have known well-marked rigors, vomiting, and headache occur at the outset,—a combination of serious diagnostic importance, as will be seen in the history of ACUTE PHTHISIS.

Essentially asphyxiating in its effects, as the anatomy of the disease prepares us to expect, capillary bronchitis is attended with variable congestion of the external surface, lividity of the lips, cheeks, tip of the nose (the ground-tint of the face being pale), external ears, finger-ends, and with fulness of the jugular veins, indicating obstructed circulation through the right side of the heart, sequential to that of the lungs. The pulse and respiration are both extremely frequent,—the latter out of proportion to the former, but, as far as I have seen, never to the extent observed in

* This is especially true in the adult: but, even in the infant, the frequency of lobular pneumonia has been greatly exaggerated by some writers, in consequence of their mistaking collapsed or inflamed and hepatised lobules.

† These are the "purulent granulations" of Rillet and Barthéz; for the form of the disease attended therewith, they propose the rather contradictory title "vascular bronchitis."

some cases of pneumonia. Dyspnoea, habitually carried to orthopnoea, and paroxysmal; sense of oppression and stuffing in the chest; cough at first almost perpetual, with exacerbations from time to time, in exceptional cases infrequent; post-sternal pain, sharp, aching, sore, slight or null; expectoration sometimes mucopurulent, yellowish green, or bright green, opaque, very abundant and free, at other times viscid, ropy, glutinous, containing exudation-matter in patches*—the whole attended with ill-developed pyrexia, hot, warm, or about natural temperature of the skin, which is sometimes moist, but free from sudamina; anxious countenance, and extreme general restlessness,—constitute the group of ordinary symptoms.

The urine is small in quantity, of strong urinous odour, deep colour, and high gravity. Temporary slight albuminuria may occur. The very highest amount of asphyxiating disturbance of respiration does not entail as a necessity the presence of sugar.† Dr. Garrod relates a case in which he detected a little sugar; but the absence of this after recovery does not appear to have been ascertained.‡ I have found oxalate of lime during convalescence.

In cases tending to a fatal issue, exhaustion soon ensues. The pulse, if at first of some power, rapidly loses its strength, becoming excessively frequent,—120 to 150, but free from irregularity; the respiration, varying commonly from 36 to 50, maintains its relative frequency almost until the closing struggle.

Pulse-respiration ratios of 3·0, 2·5, or 2·25 to 1 are not uncommon; but sometimes, even so much as forty-eight hours before decease, the frequency of the respiration falls, while that of the pulse continues to rise: under these circumstances I have known a normal ratio of 4·5 to 1 coincide with a pulse beating 144 per minute.

As long as his strength permits, the patient sits erect or bent forwards; but the body gradually yields; and it is not uncommon to find patients, while still perfectly conscious, lying sideways or forwards, with the head lower than the shoulders. In rare cases, a posture of this kind is adopted from the very onset.§

The sputa gradually diminish in quantity, from failure of power to expectorate; the skin, generally livid or cyanotic in tint, falls

* I have seen white patches of the kind in the sputa of a patient aged sixty; in infancy it is not very uncommon, when under the influence of emetics, or otherwise, expectoration has been obtained.

† Murphy, U. C. H., *Males*, vol. x. p. 169,—No albumen or excess of urates present to interfere with ordinary tests.

‡ Ranking's *Retrospect*, vol. xx.

§ Murphy, *loc. cit.* p. 157.

in temperature, and becomes covered with cold clammy perspiration, sometimes rather copious, rarely attended with formation of sudamina; the expired air grows cool;* the feet and hands swell,—in protracted cases the anasarca rising to the trunk, unaided by co-existent disease of the heart, or of any other organ promotive of dropsy; fitful dozes lapse into a state of somnolence, constant, except from momentary interruptions by the cough; muttering delirium, associated in some instances with slight convulsions, precedes a comatose state which is the immediate forerunner of death. The fatal termination is sometimes hastened by the accidental blocking-up of a large bronchus with secretion.

584. The *prognosis* of capillary bronchitis is very serious. Robust adults, may, it is true, generally be saved by active measures: but of young children and aged persons attacked, (even though free from chronic disease), it has been calculated from one-half to three-fourths perish.

The indications of fatal tendency in individual cases are, suppression of expectoration, without improvement in other symptoms, increasing viscidty of the sputa, excessive frequency of pulse and respiration, failure of heat, clammy sweats, and somnolence. Maintenance of the head on a low level from the first, in a case otherwise grave, I believe to be of evil augury.

That slackened and comparatively quiet respiration does not in itself justify a favourable prognosis, where other symptoms remain unrelieved, is inferrible from what has already been said.

585. *Duration*.—In fatal cases, the disease generally terminates in childhood by the sixth or eighth day,—in the adult drags on to the tenth or twelfth. If the alimentary canal chance to be affected at the same time—if there be gastric or intestinal irritation, the vital powers fail with even unusual rapidity. I have known life destroyed in *forty-six hours*, reckoning from the first moment of seizure, in a middle-aged adult, who had in previous years had more than one severe seizure. On the other hand, the tenacity of life sometimes exhibited in the worst cases is most singular; I have seen a patient, whose every hour appeared likely to prove his last, linger on for a fortnight. Furthermore, in very rare instances such protraction may end in recovery: I have witnessed this favorable and wholly unexpected issue, even after the general surface had become thoroughly asphyxial—after the

* Murphy (asphyxiating capillary bronchitis), U. C. H., Males, vol. x. p. 159, Jan. 1854. Temperature of ward, 57° Fahr., of surface of right cheek, 96° 50'; under tongue, 97° 33'; of expired air (thermometer held close to the lips) 68°.

act of expectoration had grown impossible,—after the cold clammy sweat, commonly precursory to death, had existed for hours,—and after the slightest reflex action of the eyelids had almost ceased to be producible by touching the conjunctiva.*

Convalescence sets in, in cases of recovery, between the tenth and twentieth days.

586. *Relapse* is less common than *recurrence*. The latter may take place within a brief period after perfect recovery from a previous attack, and destroy life rapidly,—and this apparently without re-exposure to the original cause.

587. *Physical Signs*.—The physical signs of both the varieties of simple and acute bronchitis may, conveniently, be considered together.

Little of a practically valuable kind is discovered by *inspection* in slight bronchitis: the form of the chest is not visibly altered; and, unless there be emphysema present, the perversion of movements is insufficient to attract the eye. If the disease be severe, the costo-abdominal expansion-movements assume the characters of healthy forced breathing [52]; the costal increase in amount, the abdominal decrease.† Where the dyspnoea is extreme, the lower end of the sternum and the connected cartilages sink in with inspiration. The expiration-movements are slow, laboured, and inefficient.

The *hand, applied to the surface*, occasionally detects distinct rhonchal fremitus,—its presence furnishes a rough guide to the seat of the rhonchus, as it will be scarcely transmitted to the surface, if a deep bronchus be the source of vibration. It may be more distinctly perceptible during inspiration than expiration, or *vice versa*. Dr. Stokes believes that it is more marked in the child and female than in the adult male, and at the middle and inferior parts of the chest than the superior. I have found it very remarkably developed in infants of from six to twelve months old. The state of vocal fremitus varies; it sometimes exceeds the average of health.

The *percussion-sound* may present itself in three different conditions: (a) not appreciably changed from the type of health; (b) pulmonary in excess; (c) impaired in resonance. The first

* In a case of this kind, seen with Dr. D. Fraser, very little stimulus, either alcoholic or medicinal, was taken.

† In extreme cases, however, the respiration-movement may be almost wholly abdominal. See Murphy, U. S. M., *Males*, vol. x p. 158.—"In inspiration abdomen suddenly expands, remains so for an instant, then as suddenly falls back: manner of respiration and noise accompanying it remind one of the breathing of paviours in the street."

condition is the rule, and need not be further dwelt on: the two latter are of exceptional occurrence, and call for further consideration.

(*b.*) It is by no means uncommon for exaggeration of pulmonary quality, increased duration, and slight fall of pitch of the percussion-note to maintain itself in the central regions of the back—nay, even at the base,*—in general asphyxiating and capillary bronchitis, through the whole course of the disease, and even within a few hours of death. I am aware this statement is at variance with the ordinary teaching on the subject, which leads the student to expect “dulness” at the posterior bases in protracted cases, instead of the grouped conditions belonging to the second Type [107] of morbid percussion-sound. In further support of the version of actual facts now given, it will be found that the area of grave-toned pulmonary resonance extends in front a little further downwards than natural—a truth easily ascertained over the liver—and that expiration has less effect than in health in diminishing the superficial extent and amount of that resonance. The lung is held to a certain extent in a state of mechanical distension, from diminished elasticity of its tubes and substance, from imprisonment of air by glutinous bronchial secretions, and sometimes by the actual development of acute emphysema. It is a mistake to suppose that, as a rule, any ordinary amount of local lobular collapse will counterbalance the influence of these distending agencies on the percussion-sound.

(*c.*) On the other hand slight decrease of resonance with all the characters of Type 1 of morbid percussion-sound [195] may be sometimes detected, especially at the postero-inferior parts of the chest. But this condition of sound in simple bronchitis is singularly rare; and when we reflect that considerable turgescence and thickening of the mucous membrane over a large extent of surface form part of the anatomical features of the disease, the usually normal state of resonance affords fair ground for surprise. The fact of the existence of such resonance is important; as it will commonly enable us to infer the idiopathic character of the disease, and conclude without hesitation that it does not depend upon, or attend, plastic, caseous, tuberculous or other form of exudative deposition.

This imperfect resonance, observable in exceptional cases, is

* Murphy, U. C. H., loc. cit. p. 158. This excess of pulmonary tone may hold on to the last even where heart-disease of asphyxiating tendencies coexists.—*g.* Browne, U. C. H., Females, vol. xvi. p. 29.

variously produced. Sometimes depending upon accumulation of bronchial secretion, it is then chiefly marked at the base and posteriorly, and occurs more especially in persons of debilitated constitution, or in those labouring under prostrating diseases,—as for example, typhoid fever—of which the bronchitis is only a secondary condition. In these cases there is often some congestion, or more rarely oedema, of the lung, which takes its part in lessening the amount of tone. Occasionally the deficiency of resonance seems traceable to *collapse of the general mass of the lung*, consequent on pressure on a main bronchus by enlarged bronchial glands,*—the bronchitic secretion contributing its share, at the same time, of defective resonance. But, without meaning to deny the possibility of the fact, I must observe I have never yet seen *local collapse of lobules* on an extensive enough scale in simple adult bronchitis (antagonised as it is by the distending influence of the disease on the alveoli) to justify me in looking on it as a sufficing cause of deficiency of tone.

Reference has already been made [211] to the occasional occurrence of a pseudo cracked-metal resonance in the bronchitis of young children especially. It may be added, to what is there said on the subject, that unlike the true cavernous sign, this simulation of it is changeable in place.

By *auscultation*, we learn that normal respiratory sound, weakened, sometimes, even to suppression, in the tissue communicating with the affected tubes, is exaggerated on its confines and elsewhere,—hence, especially so in the upper parts of the chest. The respiration, coarse and noisy, often more closely resembles dry rhonchal, than true breathing, sound; whence it may without impropriety be called “rhonchoid respiration.” The breath-sounds, dry and harsh in quality, are accompanied, and it may be masked more or less perfectly, by sonorous, sibilant, clicking, and bubbling rhonchi, in various combinations,—the former often of musical quality. Expiration is much prolonged and laboured. The vocal resonance is not perceptibly affected as a rule; but in some cases, probably from nasal character in the laryngeal voice, acquires a sniffling quality.

As a general fact, the sonorous and sibilant rhonchi are most marked and constant in the dry stage of bronchitis; the bubbling in that of secretion. But both orders of sound are frequently combined in the latter stage; and in some cases secretion occurs so rapidly that bubbling rhonchus is audible from the first.

* Ransom, U. C. H., Females, Nov. 1848.

When the secretion is very abundant, distinct agitation of the fluid in the tubes may be caused by the action of the heart. As was first observed by Dr. Stokes, each pulsation of the heart then causes a corresponding rhonchal sound, continuing when the breath is held.

In idiopathic capillary bronchitis, in addition to the signs belonging to bronchitis generally, auscultation discovers fine bubbling rhonchus at both bases posteriorly; coarser rhonchus higher up. If abundant and minute in its bubbles, this rhonchus indicates very positively that the capillary tubes are inflamed; but as fine bubbling sometimes occurs inferiorly to a limited extent in cases running a mild course, gravitation of fluid from the larger tubes above to the smaller below, is probably sufficient to produce it on a minor scale: if confined to one base, or to one or both apices, the bronchitis it depends on is generally either of emphysematous or tuberculous origin. Tolerably fine bubbling may occur in large-sized tubes.

In intense bronchitis of both lungs, especially where any slight emphysema pre-existed, the bulk of the organs may be sufficiently increased, to push the heart slightly downward, and to the right; the organ then beats mainly at the left costal angle [61]. The diaphragm and subjacent viscera are likewise depressed to a trifling amount. Coarse respiration and noisy rhonchi may suddenly disappear from a given spot, returning after a brief interval. Laennec plausibly referred the fact to obstruction of a tube with glutinous secretion; it is noteworthy, however, that the respiration-sounds may return without expectoration having occurred, —a probable proof that mere locomotion of mucus within a tube will suffice.

588. *Diagnosis.*—The diagnosis of bronchitis of the large tubes is sufficiently simple,—dry, passing into moist, bronchial rhonchi, post-sternal soreness, expectoration non-sanguineous, first clear, then muco-purulent, accompanied with slight febrile reaction, identifying the affection. It is well to observe here, that the mere existence of dry rhonchi, is not necessarily significant of bronchitis; those rhonchi may doubtless, in emphysematous and asthmatic persons, be produced by spasm of the minor tubes.

(a.) Capillary bronchitis in the adult is distinguished from diffused pneumonia by the normal or exaggerated resonance of the chest, by the coarseness of its moist rhonchi, and their existence at both bases, by the presence of dry and clicking rhonchi, by the absence of tubular breathing, the comparative coolness and more

asphyxial tint of the skin, by the less amount of perversion of the pulse-respiration ratio, the severer subjective dyspnoea, and more marked objective evidences of laboured breathing, the deficiency of rigors of invasion, the absence of pleuritic stitch, and the non-sanguineous expectoration.

(b.) From the lobular pneumonia of childhood the distinction is less easy. Infantine lobular collapse will impair the percussion-tone as much as lobular hepatisation. Besides, the primary rhonchus of pneumonia in infancy is comparatively coarse, that of capillary bronchitis comparatively fine; and assistance from the sputa fails, as they are almost invariably swallowed. In capillary bronchitis, however, the moist rhonchus is generally much more diffused than in pneumonia, and tubular breathing does not occur; the skin too remains free from acrid heat, often becomes temporarily moist; the general anxiety is greater, the dyspnoea more urgent, and the appearance of the skin more asphyxial.

(c.) The diagnosis of capillary bronchitis and acute phthisis is considered with the latter disease.

(d.) At the outset of a pyrexial attack with bronchitic symptoms, in infancy, it often proves difficult, if not impossible, to determine whether the irritation of the bronchi is idiopathic, or a part of the initiatory evidences of an eruptive fever. The absence of rigors, vomiting, marked coryza, and lachrymation will help to distinguish the case from measles; while the deficiency of anginal symptoms or of severe epigastric and lumbar pain will be similarly useful as respects scarlatina and variola. But often certainty is unattainable, till the day of eruption has come and passed.

(e.) Typhoid (Peyerian) fever seen within the first few days, before the appearance of its special eruption, might be, and actually has been, mistaken for acute bronchitis. But the cough and dyspnoea, which lead in such cases to the error, prove to be excessively slight in proportion to the extent and loudness of the dry, or it may be moist, bronchial rhonchi; the expectoration is sometimes tinged with blood, through co-existent epistaxis; the dull leaden hue of the typhoid facies differs strikingly from its livid tint in severe primary bronchitis. Besides, rigors, vomiting, cephalalgia, abdominal pain, common initiatory symptoms in typhoid fever, are almost unknown in simple bronchitis. In the very rare instances in which they mark the invasion of capillary bronchitis, the whole special symptomatology of the latter disease stands out from the first in such strong relief as to make error next to impossible.

580. *Treatment.*—The treatment of acute bronchitis in the adult, sufficiently simple in its general indications, is often beset with difficulty at the bed-side.

It may be first inquired (assuming that such extrinsic influences have played on a given individual, as would commonly cause in him, as in other persons, an attack of bronchitis more or less grave, and assuming, further, that they have actually produced its earliest indications), whether the complete development of the disease can be prevented. In other words, may "a cold," having begun, be stopped *in limine*? The popular faith in all countries answers, Yes. That a spirituous and diaphoretic drink, taken in time, will arrest the disease in the coryzal stage is matter of almost universal credence; and the scientific opinion of Laennec lends weight to the vulgar belief. My own observation leads me to accept the teaching of Laennec; nor have I seen any proof that, if the alcoholic stimulus fail prophylactically, it renders the subsequent inflammation more severe.

First Stage.—(a.) The disease once well established, removal of blood by venesection has been held to be advisable to the extent of eight to twelve or fourteen ounces, where an extensive surface is involved, where the constitution is strong, and the pyrexia positively of sthenic type. Rarely, it is admitted, is repetition of general blood-letting called for by the special character of the symptoms; and, while the abstraction of large quantities of blood, with the view of at once stamping out the disease, is perfectly chimerical, such sacrifice of the fluid is useless for an object assigned by some writers,—the *prevention* of pneumonia, seeing that in the adult idiopathic inflammation of the tubes does not pass on to the parenchyma.* If there be strong apprehension from the past history, or from existing symptoms, of the capillary tubes becoming extensively involved, plausible grounds may be said to exist for repeating venesection, especially if the blood previously drawn have proved highly hyperinotic: but it must not be forgotten that, though we may thus control the congestive stage of the disease in the capillary tubes, there is no evidence of our being able to prevent its occurrence; and the patient will require all attainable strength for the subsequent,

* M. Boulland has, it is true, shown by his system of *saignées coup sur coup* that large quantities of blood may be abstracted in bronchitis without immediate ill effects. —Persons born and provincials migrating to the capital being the persons operated on. But, on the other hand, he has not shown that the mortality or duration of the disease are lessened by this plan, while concerning subsequent pneumonia he is prudently silent.

almost inevitable, asphyxiating stage. The determination of the amount of blood to be drawn in these cases has always been held to be the real clinical difficulty in their management; and as, unfortunately, numerical evidence is wanting on the point, the physician must in each case trust for guidance to a careful appreciation of all its attendant circumstances.

It has long been matter of accepted creed that venesection is "better borne" by the inhabitants of rural districts than by those of large towns: that is, loss of blood can to a less degree be fairly credited with sequential evil effects among the former than the latter, while its primary influence for good seems more definite and decided. Be this as it will, certain it is bleeding from the arm has in my own sphere of London observation grown year by year a rarer event.

In point of fact it has not occurred to me for many years to order venesection to be practised in acute bronchitis; nor do I find that cases, which fall under my notice at a more or less advanced stage, had been so treated at the outset. Faith in the advisability of blood-letting appears to have deserted Metropolitan practice.

(b.) In cases of medium severity, or even in violent bronchitis attacking persons of feeble power, it is commonly held that abstraction of blood by cupping between the scapulae to from four to eight ounces, or the application of from eight to fifteen leeches to the upper-sternal, infra-clavicular, or axillary regions, will suffice in the way of a first blood-letting,—to be repeated, should relief to the breathing, as shown especially by the number of respirations per minute, have distinctly followed the first abstraction, and yet have proved only temporary. But even this less amount of blood-letting is rarely called for among the residents of London: dry cupping of the chest will with propriety be substituted in weakly persons; or the exhausting apparatus of M. Junod may be applied to one or both lower extremities.

(c.) There are observers who believe in the utility of emetics at the outset,—maintaining they control the violence of the inflammation by decreasing the force of the pulse, and disgorge the bronchial capillaries. I have constantly known the first doses of tartarised antimony, given on the contra-stimulant plan, produce vomiting; but I have no evidence that the emetic action *per se* was specially serviceable. The medicine has, indeed, appeared to me quite as, if not more, efficacious, where "tolerated," than where it seriously disturbs the stomach or bowels. And when

thus tolerated, although not demonstrably so efficient as in pneumonia, tartarised antimony has proved in my experience the most effectual agent in controlling acute sthenic bronchitis. In divided doses of from four to ten grains in the twenty-four hours, it appears to hasten resolution very sensibly in the milder cases, and to advance the secretive stage in the severer. If the tendency to depression under the influence of the antimony be very marked—marked enough to excite fear that the vital powers may be too much lowered—calomel and opium are commonly resorted to instead. I entertain no question as to the superiority of tartarised antimony under ordinary circumstances,—and in truth for my own part I have not a particle of faith in the efficacy of the mercurial combination.

(*d.*) Alkalis are theoretically indicated, where the sputa are viscid, and contain exudation-matter; and when the blood is notably hyperinotic. They are useful as adjuncts, but are not to be trusted to alone and unaided.

Second stage.—(*e.*) Free secretion from the tubes being established, and the febrile action lowered, the application of a full-sized blister to the sternum, or between the scapulae (here, in consequence of gravitation, it draws off most fluid), becomes most serviceable;—mustard-poultices may, even from the first, be employed. Diaphoretics and expectorants, containing liquor ammoniac acetatis, vinum ipecacuanhae, paregoric, and similar agents, are now advisable—and these may gradually be replaced by preparations of a more stimulant character, such as tincture of squilla, and the ammoniated tincture of opium of the Edinburgh Pharmacopoeia. Dilute hydrocyanic acid and the tincture of lobelia inflata, especially if there be spasmodic tendency in the cough, and the fear of serious depression be past, will lend valuable aid. If the abundance and fineness of the moist rhonchi indicate tendency to bronchial accumulation, emetics now become of signal service, by mechanically clearing the tubes. The sulphate of zinc, as entailing little or no constitutional depression, is the best agent of the class; and may in urgent cases be repeated twice, or even thrice, in the day.

(*f.*) In a yet more advanced condition of the disease, if there be inclination to lapse into a chronic state, carbonate of ammonia, senega, the balsamic medicines, copaiba,* gum-ammoniacum, and

* Were it not for the nauseous pungent flavour of copaiba and its tendency to produce gastric discomfort, it would in my opinion deserve the first place among drugs of its class in the condition of things supposed.

compound tincture of benzoin, are distinctly serviceable in moderating the amount of secretion, facilitating its discharge, and so relieving dyspnoea.

(g.) Throughout the whole course of treatment, gentle laxatives should be used. It would be difficult to prove, it is true, that the duration of the disease is prolonged by confinement of the bowels, but most certainly fulness of the abdomen increases dyspnoea, and discomfort in the chest. On the other hand, I have never seen any utility in severe counter-irritant purgation.

(h.) The temperature of the room should range from 64° to 66° or 68° Fahrenheit, or even higher under special circumstances, such as very chilly temperament or previous residence of the patient in a warm climate. The moisture of the atmosphere may be regulated according to the patient's feelings by evaporating water from a dish near the bed; violent paroxysms of cough and dyspnoea may often be relieved by this simple plan. Occasional free ventilation of the room, the patient's head being protected at the time, is essential to his early recovery,—he wants all obtainable oxygen. Flannel should be put on next the skin, if not previously worn.

(i.) *Asphyxial variety*.—If the disease have actually assumed an asphyxiating character, when the patient is first seen, no matter how that character have been produced,—that is whether by implication of the capillary tubes, by very extensive seizure of the minor ones, or by moderate inflammation occurring in an asthenic state of the system,—lowering measures of any kind must be employed with the extremest caution. This is the more true, as it is especially in *aged* persons the disease is liable to pass suddenly from a very mild state, apparently scarcely requiring medical management, to one of the gravest character. The abstraction of a few ounces of blood may, under such circumstances, be followed by vital depression, which very manifestly hastens the fatal issue, and is perhaps occasionally its real cause. At least such is the conviction to which I have been led by observation. But this conviction is not shared by all, especially in the case of general capillary bronchitis. Thus Valleix appears,* maintaining that “abundant and repeated general bleeding, emetics in large doses, cutaneous revulsives and strong purgatives, must be employed with perseverance” in this form of the disease. Such treatment would, I believe, prove actively destructive, if adopted in London.

According to the plan on which I proceed, local dry cupping,

* Bull. Gén. de Thérapeutique, Avril, 1847.

or the application of Junod's apparatus to the limbs, counter-irritation of the chest by mustard poultices and blisters, in association with, internally, stimulant expectorants, especially the sesquicarbonate of ammonia, in doses of from three to ten grains every second or third hour, combined with squill, serpentaria, and senega or ammoniacum, constitute the staple of the treatment. I have pretty extensively employed muriate of ammonia, in doses of five to twenty grains, but am persuaded it is a less active agent than the sesquicarbonate. Chlorate of potass, in doses of from five to twelve grains every hour, sometimes appears to act favourably in warding off seemingly imminent asphyxia, but is on the whole of much inferior efficacy to the latter salt of ammonia. The patient's strength must be supported by strong beef tea and jellies: and wine or brandy given in frequent doses to sustain his calorific power.

(k.) In the more serious cases of bronchitis, it is exceedingly probable, the muscular coat of the tubes loses its contractile force. Now that coat appears, in the calm, and still more in the forced expiration, of health, to possess the power of reducing the tubes to less than their medium size; * the elasticity of the inflamed bronchi must likewise be impaired according to one of the acknowledged laws of inflammation. And so become easily intelligible the tendency to dilatation of the tubes, the laboured expiration, and the accumulation of secretion, characteristic of the acute disease. And hence, more particularly as bronchial paralysis and air-distension of the lung are known to follow section of the *par vagum*, it seems right that, as a final resource, galvanism, in the course of that nerve, should be tried in cases of asphyxiating bronchitis. I must, however, admit I have tried strychnia at a pretty early period of the asphyxial stage, and in sufficient quantity to produce well marked "physiological" effects, without favourably influencing the respiration.†

Per contra according to Breithaupt,‡ chloroform-inhalation becomes of great value where the dyspnoea is severe from obstruction of the air-cells.

(l.) In infants, as M. Valleix has shown, life may sometimes be saved under the most desperate circumstances by passing the finger backwards to the epiglottis, and bringing away viscid secretions choking the air-passages. Prolonged insufflation of the

* *Vide* an interesting paper by Dr. Radclyffe Hall, "On the Action of the Muscular Coat of the Bronchial Tubes in Respiration."

† *See* Murphy, U. C. H., loc. cit.

‡ *Med. Times and Gaz.*, May, 1856.

lungs has also been employed with success, even where the infant had already fallen into a state of apparent death.*

(II.) CHRONIC BRONCHITIS.

590. Chronic, like acute bronchitis, varies greatly in severity.

591. *Symptomatic Varieties.*—I.—In one class of cases slight cough, with yellowish-white muco-purulent expectoration, moderate in quantity and easily voided, attended with little or no post-sternal soreness or pain, affecting but very slightly the general health, appetite, and flesh, appearing in winter, and ceasing on the approach of the mild season, constitutes clinically the whole of the disease: this is the slightest form of "winter cough."

592. II.—In a second class of cases the cough is more violent, and more constant, severest in the mornings; the expectoration scanty and adhesive, or easy and copious,—under the latter circumstances consisting of large nummulated masses, floating, semi-sinking, or wholly sinking, in water, non-aërated or scarcely aërated, ash-coloured, yellowish green, deep green, or in very rare cases of a tint almost like Scheele's green, remaining separate, or forming a single liquid collection, slightly streaked occasionally with blood, when the cough is excessively violent, and especially if the left side of the heart be obstructed in the slightest degree, but never accompanied with actual hæmoptysis,† of peculiar nauseous odour, sometimes fœtid, smelling like wet mortar, or putrescent matter,—in rare instances, especially where the bronchi are dilated, evolving the same fœtor as in gangrene of the lung. Such fœtor may exist without destruction of substance visible to the naked eye; whether microscopical sloughs are separated in such cases (a fact I have not succeeded in positively substantiating), or whether rapid decomposition of the secreted fluids takes place immediately on their production, I am unable to affirm: the reality of gangrenous odour in the secretion of an unbroken surface is difficult enough of admission.‡ The varieties of tint are inexplicable by any character discernible either with the unassisted eye or microscope, and are probably due to the chemical nature of the fluid.

Microscopically, the sputa consist of epithelium, pus-cells,

* Union Médecale, Avril, 1852.

† "Expectoration of blood, in persons labouring under chronic bronchitis, with or without emphysema, but without notable disease of the heart, justifies in itself a suspicion of the existence of latent tubercles."—Author's Report on Phthisis, as observed at the Brompton Hospital: Brit. and For. Med. Chir. Rev., January, 1849.

‡ The odour is probably often merely simulative of that of gangrene. An analysis in the Edinburgh Laboratory, conducted at the request of Dr. Laycock, showed the presence of lactic and acetic acids and methylene. (Med. Times, May, 1857.) But the precise chemical products probably differ in different cases.

exudation-cells, and a few blood-discs. Exudation-matter in patches, sometimes exhibiting inclination to the moulded form, may occasionally be seen, on carefully disentangling the sputa under water, either with the help of a common lens, or even with the naked eye.

593. There is no great pain, heat, or soreness in the chest, except after fits of coughing, when it is mainly post-sternal. The respiration ranges scarcely out of proportion with the pulse in frequency, —both being raised, slightly as the habitual state, materially during and shortly after paroxysms of coughing, above the individual standard of health. The appetite fails, the sleep becomes broken, and flesh wastes very perceptibly: I have known as much weight lost during the first three weeks of an annual recurrence of chronic bronchitis, as during the same period in the average of cases of consumption in active progress; *—but in bronchitis the weight ceases to diminish after a certain time; in phthisis its diminution, though fluctuating according to laws as yet unestablished, holds on in the main. The temperature rarely rises above sub-pyrexial averages.

594. Should an acute attack or severe exacerbation of the disease, particularly if it involve the capillary tubes, occur in a person afflicted with this serious variety of the chronic form, the expectoration becomes in part more viscid, transparent, and highly frothy for a variable number of hours or days; then, relapsing into the simply purulent state, grows so excessively abundant as in itself to account partly for the rapid debility that ensues. The laboured respiration, hurried somewhat out of proportion to the pulse, lividity of the lips, malar bones, chin, tip of the nose and finger-ends, coolness of the hands, feet, and, it may be, of the extremities generally, clammy perspiration, sometimes rather copious, coolness of the expired air, inability to lie down, sensation of pulmonary oppression and want of air, all point to the asphyxiating character of the attack. Fitful dozes give but temporary relief to rapidly progressive exhaustion, and, leading to accumulation of secretion, increase the suffering felt on waking. Here is a condition of extreme danger, principally observed in the aged (*senile bronchitis* and *peripneumonia notha*), and one of the most frequent causes of their death.

595. III.—In a third class of cases, the prominent feature of the disease is a peculiar flux from the bronchi,—whence the name *bronchorrhœa*. In this variety paroxysms of cough and dyspnoea,

* This important fact is a sufficient commentary on the published assertion, that the diagnosis of phthisis may be made with the balance.

which may be of almost daily occurrence, or even more frequent, are relieved by copious expectoration of a thin watery fluid, or of a ropy, gluey, transparent substance, like raw white of egg mixed with water,—a quarter of a pint of this may be secreted in the course of half an hour on the decline of a paroxysm. Though sometimes fatal to old people, from their want of power to throw off the accumulated secretion, this form of the disease seems occasionally useful, when slight, in relieving pulmonary congestion dependent on obstructive or regurgitant disease of the mitral orifice, and should not, under these circumstances, without mature consideration, be, at least, completely removed,—granting, *argumenti gratiâ*, we possess the power to effect such removal.

596. IV.—There is a fourth variety of chronic bronchitis, to which the rather contradictory name of *dry catarrh* was given by Laennec, characterised by exceedingly troublesome cough, oppression of breathing, tightness of the chest, and sometimes extreme dyspnoea; expectoration being totally deficient, or consisting of semi-transparent, small, grey, pearl-like, roundish particles. An attack of ordinary bronchitis, with muco-purulent secretion, may occur in such cases, and put a period for a time to the chronic disorder. Pathologically dry catarrh seems to consist in active congestion of the tubes; clinically it is allied to, and often associated with, vesicular emphysema.

597. *Physical Signs*.—The physical signs of chronic bronchitis are essentially those of the acute disease. There are certain modifications worth attention, however, especially as no single specific sign, distinctive of the two forms, exists.

(a.) Taking the results of a mass of cases, the percussion-sound can scarcely be said, as a rule, to differ from that of health. If, on the one hand, congestion and thickening of the bronchial walls, coarctation of the tubes, and collapse of lobules or larger portions of lung tend to impair its fulness of tone, on the other, the existence of air-distention and emphysema tend to augment the average resonance. Local accumulation of secretion and consequent obstruction sometimes render spots more or less toneless one day, which the next recover their normal resonance. But it must be remembered, that the percussion-sound at the posterior bases, in cases of chronic bronchitis with acute recrudescence, may by possibility acquire all the characters of the dull type [195]; and the respiration become high-pitched, and of bronchial or even diffused blowing quality. Not unoften this condition of things, really due to sero-sanguineous infiltration, has been

mistaken for evidence both of pneumonia and of pleuritic effusion. When, as sometimes happens, one side only is thus impaired in resonance, the error is very easily committed, and probably furnishes a clue to the alleged enormous frequency of fatal pneumonia among the aged population of certain localities.

(b.) Chronic bronchitis tends to distend the lungs *generally* (though, from bronchial obstruction in some spots, it may have the reverse effect on them *locally*), and hence to widen the chest, and even depress somewhat the heart and diaphragm. But it is very difficult to demonstrate to what amount unaided chronic bronchitis is capable of carrying these changes; it is so constantly associated with their more active and positive cause—emphysema.

(c.) The respiration-sounds vary in force and quality widely in different parts of the same lung. The quantity of the respiration falls on the whole greatly below the average; harsh and coarse, the loud inspiratory and expiratory sounds, audible in some spots, differ wholly in character from those of true exaggerated respiration, are probably produced in the capillary and larger tubes, and resemble dry rhonchi in properties (sonoro-sibilant respiration). Full respiration will sometimes become audible, after free expectoration, in a spot where a moment before none, or next to none, could be caught. True blowing respiration is never heard in bronchitis. The rhonchi are those of the acute disease; the vocal resonance variable,—either feeble, or weakly, or strongly, bronchophonic.

508. *Anatomical Characters.*—Anatomically, the disease is known by discoloration of dull red tint, greyish or brownish, of the mucous membrane, evenly or patchily arranged, with a congested, widened, and sometimes varicose state of the fine and capillary vessels, unevenness of the mucous membrane and epithelial abrasion. The walls of the tubes are thickened and hard, from infiltrated induration-matter, which sometimes extends beyond them, and encroaching on the adjacent lung-substance, obliterates its capillary vessels. The pressure of this matter diminishes the calibre of the tubes, both directly and indirectly by circular constriction; and actual obliteration of the finer bronchi may occur, where in addition exudation-matter has hardened in patches on their internal surface. Neither ulceration nor sphacelus, visible to the naked eye, belong to simple chronic bronchitis. The longitudinal and circular muscular fibres are sometimes much hypertrophied. The cartilages of the larger tubes occasionally calcify.

In the acute disease the bronchi may, as we have seen, undergo dilatation,—the more readily, the younger the individual. There is every reason to believe that, with the recovery of the tone of the bronchial muscles, the tubes gradually resume their natural form. I have seen cases of intense bronchitis in childhood, lapsing into the chronic state, and attended with signs apparently depending on widening of the tubes, which signs have gradually and totally disappeared. So likewise in the chronic disease, the bronchi sometimes dilate; but, once established, the dilatation remains a permanent evil* (*vide* Dilatation of the Bronchi and Cirrhosis of the Lung).

599. *Diagnosis*.—Pleurisy and pneumonia can only be simulated by chronic bronchitis in those comparatively rare cases, where the percussion-sound loses tone at one or both posterior bases [597]. Now the persistence of vocal fremitus will habitually distinguish the toneless percussion-sound of bronchitis from that of effusion; the deficiency of true tubular metallic breathing from that of pneumonia. In the latter case, too, the pulse-respiration ratio may be appealed to with confidence; it is never perverted, even in this *accumulative* bronchitis, to the degree that it is in pneumonia: besides, though the vocal resonance may be strongly bronchophonic, it is not tubular, sniffling, and metallic, and there is neither rusty expectoration nor acrid heat of skin.

The real difficulty in diagnosis consists in the distinction between certain cases of chronic bronchitis and phthisis; as the difficulty especially arises where dilatation of the bronchi exists, I defer to the history of this disease the consideration of the point.

600. *Prognosis*.—Chronic bronchitis is rarely got rid of completely by persons of middle and advanced age, in whom it has recurred for more than one or two winters; in the comparatively young, especially if circumstances allow of their moving to an appropriate climate, it may be radically cured, in some of the number, so long as they remain in that climate, in a yet more fortunate few, even when they return to the soil where they were originally seized.

Chronic bronchitis can scarcely be correctly said to kill *per se*; but it certainly paves the way for death in multitudes of aged persons—the immediate cause of the fatal event being an acute attack of general or capillary inflammation of the tubes. I

* Osmond, U. C. H., *Malac*, vol. iv. p. 343.

am aware that in cases of this class terminating fatally, the result is commonly held to be immediately brought about by pneumonia: a notion derived sometimes from the occurrence of dulness under percussion at one or both bases, sometimes from *post-mortem* examination,—sometimes from both sources. I have already pointed out the source of fallacy in the percussion-dulness referred to [597]; and I have great doubts of certain “consolidations” found after death (*peri-pneumonia notha* in more senses than one) being truly pneumonic. It has not occurred to me to meet with such consolidation, except where there was co-existent heart-disease, and more especially of the mitral orifice,—consolidation hence mechanically, and not actively congestive, and in point of fact quasi-apoplectic. Sometimes there is mere collapse.

601. *Treatment.*—(a.) In the treatment of chronic bronchitis, whether accompanied or not with dilatation of the tubes, I believe it to be unadvisable to take blood from the arm, even during acute exacerbations;—the strength fails rapidly in such cases from loss of blood; and bleeding at the outset has often been really chargeable with producing that form of asphyxia at the close, from inability to expectorate, which so often proves the immediate cause of death. A few ounces, say, about four or five, taken locally by leeching or cupping, are as much as may, in any case, be abstracted without fear. Freo dry cupping, with flying blisters applied occasionally to different parts of the chest, are among the most effectual means of counteracting the ill effects of acute exacerbations.

In the purely chronic state, counter-irritation, with tartar emetic, croton oil, or the turpentine and strong acetic acid liniments, is essential in the treatment, unless emaciation be very far advanced, or the skin peculiarly irritable. The inhalation of tar vapour, creasote vapour, iodine, or chlorine, most unquestionably reduces the irritability of the mucous membrane and the quantity of secretion; the results of M. Cottereau, with chloruretted inhalations, are peculiarly important, and show, as admitted by M. Louis, that singular advantage may be obtained through them, even where the general symptoms closely simulate those of phthisis. Of the remarkably beneficial effect of inhaled vapour, impregnated slightly with creasote, or, better still, with carbolic acid, I can speak with very considerable confidence. If the cough be particularly irritable and there be any tendency to congestion of the lung-tissue, extra caution is requisite in the employment of these agents, but even under these circumstances they are by no means

to be discarded. Where notable irritability of the mucous membrane exists, it may be gradually prepared for the stronger preparations by the inhalation of extract of hyoscyamus, or conium. If there be spasmodic tendency, the latter drug may be rendered powerfully antispasmodic and sedative by the addition, on the instant of use, of a few drops of liquor potassæ.*

Various forms of dry inhalation are recommended. I have certainly, in strumous persons with copious expectoration, and not advanced in years, seen favourable effects from the inhalation of vaporised iodine, in the manner to be described under the head of Phthisis, though never such striking results as in some rare cases of the latter disease.

(b.) The choice of internal remedies will vary with the condition of the discharge from the tubes, and the amount of general reaction. If there be little expectoration, an excited circulation, and a tendency to congestion of the parenchyma, tartar emetic in small doses, ipecacuanha, or colchicum, are the best agents, combined variously with hydrocyanic acid, lobelia inflata, belladonna, stramonium, hyoscyamus, paragoric, or other drugs of similar properties.

In a few cases, where great dyspnoea and arrested secretion pointed to the existence of abruptly acute congestion, I have seen mercury apparently very rapidly lower the circulation, and induce free discharge. But, as a rule, mercury has appeared to me so utterly valueless, that in the few exceptional cases I cannot help suspecting the existence of chance coincidence. If there be but little vascular excitement, aquill, senega, ammoniacum, with opium, are preferable combinations. Balsam copaiba and the compound tincture of benzoin may be joined to the stimulants,—the former especially seems to exercise a specific soothing effect on the mucous membrane. Muriate of ammonia has appeared to me effective in two apparently opposite ways,—by promoting expectoration where deficient, by controlling its amount when excessive. Medicinal naphtha will also produce this latter effect; so abruptly, indeed, sometimes, that slight hæmoptysis may follow the suppression of secretion,—this, however, only in persons obviously or probably tuberculous.

Iodide of potassium, in sufficient doses to produce slight iodism, occasionally relieves the dyspnoea and chest-oppression to a very

* The most convenient and cheapest inhaler I know of, is that designed by Dr. Sturt.

striking degree;—in such cases (assuming they are non-syphilitic) does it promote absorption of exudation-matter?

From ordinary alkalies I have seen no positive benefit, except where the individual was of rheumatic or gouty diathesis; and then the accompanying bronchitis was not, properly speaking, of the simple variety now under consideration. Where the latter diathetic vice exists, small doses of colchicum are distinctly beneficial. Sulphur in small non-aperient doses is held by some persons to exercise specific influence on the disease: the undoubtedly favourable effect of certain sulphurous mineral waters seems to explain this belief.

Hydrate of chloral in small doses of seven to fifteen grains, in association with expectorants, may be employed when spasm is a dominant feature.

The jellies made from Iceland and Carrageen mosses both soothe the cough and afford nourishment. If emaciation occur, cod-liver oil should decidedly be employed;—many of the good effects of the oil, as observed in phthisis, are yet more readily produced in chronic bronchitis. Bark and the mineral acids are useful in controlling debility, and improving the appetite: if anæmia supervene, iron becomes essential.

(c.) The diet should be nutritious and non-stimulant. The pitch-water, recommended by Laennec for ordinary drink, mixed or not with milk, is certainly deserving of more extensive use than it has met with in this country—especially if general experience ratify his assertion, that it has occasionally actually cured the disease.

(d.) During the winter months in this climate, a steady temperature of 63° to 65° Fahr. should be maintained indoors;* and the mouth and nose protected by a respirator, or otherwise, out of doors.

(e.) Where circumstances permit, change to a more genial climate, either for the winter or permanently, coupled with the use of certain mineral waters, furnishes the most effectual means of relief and cure. The mean temperature of the locality chosen should be some degrees higher than any attainable in this country; the principles of correct selection are explained in Part III. The Eaux Bonnes, St. Sauveur and Caunterets in the Pyrenees, and Ems in Nassau, may be instanced among the mineral springs at once most efficacious and most easily reached.

* This statement accords with general experience; yet, on theoretical grounds, breathing air, for an hour at a time, artificially lowered in temperature to 50° or even 40° Fahr., has been seriously recommended and employed by Dr. Drake, of New York. I am not aware of the system having been tried in this country.

602. During the paroxysm of *bronchorrhœa*, the hot bath, or hot air-bath, sinapisms to the extremities, emetics, full doses of lobelia inflata, and, if there be failure of vital power, sesquicarbonate of ammonia and brandy, are the chief remedies.

603. The practicability of injecting the bronchial tubes with solution of nitrate of silver, is considered in connection with the treatment of tuberculous laryngitis.

604. In the treatment of an acute attack, supervening on the chronic disease in a person of advanced years, the caution already given as to blood-letting in simple acute asphyxiating bronchitis seems to me of yet greater importance. Here it is not the inflammation that kills: it is the vast accumulation of muco-purulent secretion supplied by a congested surface—secretion which prevents oxygenation of the blood, and which the strength of the patient fails to throw off—that really destroys life: the brain and tissues become poisoned, too, with venous blood. Sesquicarbonate of ammonia is, in such cases, required almost from the first: it is best given in combination with squill and nitric ether. If any sinking tendency appear, spirits of chloroform and succinated spirits of ammonia are probably the best medicinal stimulants: but brandy and wine are more agreeable excitants, and quite as efficacious,—the former especially should be administered with no sparing hand. Nux vomica and galvanism are worthy of trial as direct stimulants of the muscular coat of the bronchial tubes; and intra-thoracic congestion might be relieved by the cautious application of Junod's apparatus to the lower extremities.

(III.) VARIETIES OF BRONCHITIS.

605. The varieties of bronchitis may be classified as follows:—

Varieties dependent on—

- | | |
|---|--|
| 1. Period of life | Bronchitis at birth; infantile; adult; senile |
| 2. Nature of secretion | Dry, serous, muco-purulent; plastic. |
| 3. Nature of cause | Mechanical bronchitis, hay-asthma. |
| 4. Amount of prevalence and specific or non-specific cause. | Sporadic; epidemic influenza. |
| 5. Association of spasm | Hoarse cough; asthmatic bronchitis. |
| 6. Secondary origin | Secondary to— |
| | Acute specific diseases. Typhoid and typhus fevers, septicæ, the exanthemata. |
| | Hæmorrhagic diseases. Heart rheumatism; Bright's disease; glycosuria,* scrofula, jaundice, hæmex, purpura, cancer. |
| | Local thoracic diseases. Tubercle, cancer, chronic inflammation of the lung; heart disease; aneurism of the aorta, &c. |

* Suggested (from γλυκός—σίμα) as a substitute for "saccharine diabetes."

The peculiarities of some of these varieties have already been referred to, and do not precisely call for detailed description; and Influenza and Hooping Cough are elsewhere made the subjects of separate sections. Some few of the other varieties may be specially considered here.

A.—PLASTIC BRONCHITIS.

606. We have already seen that plastic exudation-matter forms, though to a limited extent, in simple bronchitis; the profuse production of such matter distinguishes one variety of the disease, which is probably, though not demonstrably, dependent on a peculiar diathesis,—for, in truth, of particular causes nothing is known. The affection occurs with not very unequal frequency in both sexes, with slight excess in females, and is seen at all ages. The immediately exciting causes are those of simple bronchitis; why, then, is the secreted product different? There seems reason to believe the disease less uncommon in this country than on the continent.

607. An affection of great rarity, true plastic bronchitis is anatomically characterised by the formation of solid or tubular, stratified or non-stratified, concretions of exudation-matter of low type* within the bronchial tubes,—sometimes reaching, more or less extensively, from their finest to their largest divisions, and then exhibiting the dendritic form in the most remarkable manner. The disease has little tendency to spread upwards: the trachea remains unaffected; the voice, though sometimes becoming slightly husky, habitually retains its natural quality and strength. On the other hand, plastic inflammation extends downwards from the larynx to the bronchi in a certain proportion of cases of primary croup, and also from the throat and larynx in diphtheria;† but these cases are purposely excluded from consideration here.

608. Although not unknown as an acute disease, especially in infants, in whom it may run its course, and disappear (as the event proves, permanently), at the end of ten days or a fortnight, clinically plastic bronchitis is especially distinguished by its chronicity, its frequent acute broncho-pneumonic recrudescences, and its comparatively slight influence on the general health. In one case, which I have long had under occasional observation,‡

* I have found them to contain exudation-cells; some nucleated, the majority not so. In the main, the material is fibrillar or amorphous.

† Woodger, U. C. H., *Females*, vol. xv, p. 39. In this instance the diphtheritic exudation spread from the throat to the third divisions of the bronchial tubes.

‡ Moss, U. C. H., *Females*, vol. i. p. 187 (1846), and vol. iii. p. 53 (1848).

expectoration of casts commenced in the spring of 1843, and, with occasional brief intermissions, continued up to the time the patient, a young female, was last seen, June 1857. Between 1850 and 1857, she had married, but without any consequent change in the bronchial disease.

609. *Physical signs.*—The dry rhonchi of simple bronchitis, mixed to a small extent with the moist, may be heard from place to place. But there are more distinctive and really special physical signs: disappearance of all respiratory sounds in given spots of the lung, from time to time, marks complete obstruction of a large bronchus communicating with those spots,—and percussion-dulness, as complete as in pneumonic consolidation, dependent on collapse of the lung-substance, may be found co-extensively with the deficiency of respiration, as I have had repeated occasion to observe. If the obstructed tube be one of really large calibre, the inspiration-play may be very perceptibly impeded over the entire side. Local pneumonia, attended with pain, rusty, viscid expectoration, true crepitant rhonchus, and blowing respiration, also now and then occurs in these cases,—generally speaking, running its course uninfluenced, at least to any perceptible degree, by ordinary treatment. Where a very large tube chancs to be blocked up, asphyxia may be temporarily threatened;* and oppression of breathing, disproportionate to the apparent amount of disease, is always a prominent symptom.

610. *Symptoms.*—The expectoration of the casts is generally preceded by some hours' dyspnoea and hacking dry cough; and in rare instances, obviously in consequence of abrupt blocking up of the communicating tubes, no expectoration of significant character may take place for some days after the outset. During the periods of acute attack, I have found the pulse-respiration ratio vary from 2·2 : 1 to 3·5 : 1. During these attacks, casts of notable size are brought up, generally from three to six or seven times a week,—but small fragments are much more frequently expectorated.

The expectoration of casts may go on daily without causing any notable suffering,—if the size be small, and the processes of detachment and expulsion easy. Unless the sputa be closely examined under water, particles of concretion escape notice amid the coatings of viscid mucus with which they are generally associated.

* U. C. Museum, No. 2124. Numerous other specimens exist in the collection.

Streaks of blood, either on the external surface of the casts, or, more rarely, on their internal surface, if they be tubular, are not uncommonly seen; and spitting of florid blood in streaks, or even in drops, mixed with mucus, for a short while after their expectoration, occasionally occurs. This is especially the fact at the height of the acute attack. As this wears off, the concretions and the expectoration become bloodless.

Some very rare cases have, besides, been observed, in which copious hæmoptysis had occurred for some time previous to the expectoration of solid casts of the tubes. The nature of these cases, however, requires further investigation. Certainly they do not belong to the same class as true plastic bronchitis; the concretions are most probably simple fibrinous coagula from hæmoptoic blood, itself the result of tuberculous disease. In no case of the kind, that I have read the record of, was the absence of tuberculous disease proved: and, on the other hand, the occurrence of moulded coagula in ordinary tuberculous hæmoptysis, though, for obvious reasons, rare, is sometimes (I have seen it myself) positively observed.*

In a case recorded by Dr. Peacock, a moulded piece of encephaloid cancer was expectorated, simulating a fibrinous cast.†

611. *Prognosis.*—Plastic bronchitis is said to occur occasionally “as a complication of phthisis and other grave diseases.”‡ I have never seen the true disease either in life or in death in an actively phthisical person, and cannot help questioning the reality of its occurrence except as one of the *mirabilia* of morbid anatomy: for many many years, let me observe, I never opened a body, cut off by any disease whatsoever, without cutting down the bronchi to their minutest divisions. If the plastic affection does so appear, its prognosis would become that of the primary disease.

The true idiopathic affection (I have had five well marked cases under observation), I believe, neither destroys life, nor does grave damage, local or general. In an acute attack present cure, future recurrence, may safely be predicted.

612. *Treatment.*—In the acute disease in childhood the free use of emetics has been strongly advised: but, up to the present time, advised on purely theoretical grounds; for I can trace no

* Within the last two or three years a remarkable case of expectoration of moulded fibrinous blood-casts has fallen under my notice, in which repeated exanthematics in the intervals of the attacks failed to disclose any physical signs of diseased lung-substance.

† Path. Trans., vol. x p. 65.

‡ Peacock, Med. Times and Gaz., Dec. 1854.

evidence of their special utility in records of observed cases. It seems to me, that in the present state of knowledge we have no trustworthy guide to deviation from the ordinary practice in acute bronchitis. It would be well, as in cases of croup, to keep the atmosphere of the room saturated with moisture.

Similarly, during the period of acute seizures in the course of the chronic disease, the treatment, so far as I know, should be conducted on the same principles, as if the secretion-products were of the ordinary kind. I have not seen any benefit derived from mercurial action on the system; nor have I found liquor potassæ exhibit the solvent power that might have been anticipated. Mischief may readily be done by an over-active treatment designed to control an imaginary pneumonia. The young practitioner must not confound the local dulness under percussion, which may come on in a few hours in these cases, as a result of obstruction of tubes, with true pneumonic loss of resonance. The weak or suppressed respiration of the former condition, the tubular blowing of the latter, ought to protect him from error.

And in the intervals of these acute seizures can any effectual measures be taken either to prevent their recurrence, or to ensure secretion of different type, if the bronchial tubes must needs become, every now and then, inflamed? I believe few affections of the lungs are more difficult to cure permanently than this. Theory leads to the use of iodine by inhalation and otherwise, and suggests a prolonged trial of alkalies and their carbonates as diminishing the tendency to hyperinosis. But I have perseveringly employed these remedies without any enduring effect on the disease. It disappears for a time, to return again without obvious cause,—a mode of progress which can only be plausibly referred to the influence of a persistent diathesis. I should have supposed a well-selected climate must have exercised a modifying influence on the distinctive peculiarity of the disease: now, chance brought the young woman above referred to, to Buenos Ayres (a climate of undoubted salubrity in regard of bronchial affections); but a sojourn there of four months, whilst it improved her breathing, strength, and general health, did not prevent her from frequently expectorating the usual moulded casts.

If the influence of a diathesis be really concerned in the peculiarity of plastic bronchitis, it is certainly what I would call a *local diathesis*, producing no perceptible textural harm in any other part of the frame, and leaving the constitutional health untouched. The disease has fallen under my notice, in its most

persistently recurring form, in persons exhibiting all the attributes of robust and vigorous youth, and living after the most perfect hygienic models. In one case of this kind the diathesis apparently wore itself out at the end of some years,—bronchitis and congestion having since occasionally occurred without a particle of moulded secretion making its appearance.

R.—MECHANICAL BRONCHITIS.

613. Under this head range themselves those well-marked varieties of broncho-pulmonary disease, induced by the inhalation of irritating particles of various kinds. The primary seat of irritation is plainly the mucous lining of the bronchi,—but more or less rapidly the lung-substance becomes involved. Dilatation with thickening of the bronchial tubes and emphysema ensue early; and low inflammatory action in the parenchyma leads to exudation of material of feeble plastic force, which softens, carries with it the disintegrated lung-tissue within its aren, and so leads to the formation of excavations. There is no pathological relationship between this form of softening and the presence of tubercle or any other variety of diathetic infiltration: if such be present, it is matter of simple coincidence.

614. The materials acting thus irritatively are very various:—vegetable; animal; mineral and metallic.

615. (a.) *Vegetable*. Among the most important vegetable irritants are corn-dust, seed-dust, that of certain grasses (especially Italian rye-grass), and in rare instances ordinary sawdust. The silicious dust of the husks is the mainly noxious agent in the case of the cereals,—unloaders of grain-ships are among the principal sufferers.

Hemp-particles, flax-dust, cotton-flue, act as causes of the disease in hemp-spinners and cotton-batters.*

Coal-dust among coal miners and coal-heavers proves a less active cause than might be expected; the so-called "coal-miners' phthisis" [624] is in reality essentially the result of the inhalation of the soot of the oil-lamps used in working, where the safety lamp is not employed,—the disease being found with the

* It is remarkable enough that the operatives in the cotton-mills near Vienna enjoy better health than the general mass, the annual deaths in the general population being 1 in 27, in the manufacturing class 1 in 36. (Clendinning's San. Rep., p. 114.) Villermé found in France that neither carders, spinners, combbers, nor winders appear more subject than others to particular diseases: but batters of cotton, rubbing much dust and flax, do get the so-called cotton-phthisis and cotton-chitis.

carbonaceous character in miners of other descriptions. Sweeps suffer from bronchitis from the inhalation of soot.

(b.) *Animal*.—Feathers, wool, and bristles are the materials belonging to this class: wool-carders, bedding-makers, brush-makers, and bristle-drawers, the sufferers.

(c.) *Mineral*.—Here are found stone-grit, glass-grit, and china clay used in the manufacture of calico. Grinders, stone-cutters, quarry-men, glass-cutters, and calico weavers are those mainly affected.

(d.) *Metallic*.—Metallic particles are the essential source of the disease in knife-grinders, metal-turners, and needle-pointers.

616. In the immense majority of cases the disease engendered in these manners runs a chronic course; but it would seem that in the grinders of cereals the inflammatory changes in the lung-substance may destroy life in a few days.*

617. In some of these trades the irritant particles appear to be swallowed as well as inhaled,—and various gastro-intestinal disturbances follow. In workers with hemp especially, gastrodynia, pyrosis, jaundice, dysentery, &c., are observed, as well as the chest-mischief.

618. Two of these varieties deserve separate consideration.

(1.) KNIFE-GRINDERS' DISEASE.

619. The anatomical characters of this disease, known in its chief *habitat*, Sheffield, as "Grinders' Rot," or "Grinders' Asthma," may be enumerated as follows:—1st. The special conditions of chronic bronchitis, thickened walls, dilated calibre, rather in the finger-glove form than the globular; emphysema; lung-consolidation, dull white in colour, excessively hard and tough, fibroid in intimate constitution—in fact more or less densely and perfectly cirrhotic, and patchily infiltrated with melanic pigment. No true pulmonary tissue can be traced within the area of the cirrhotic parts. Breakages occur, and cavities of various sizes form, filled with purulent secretion.

620. The physical signs are complicated, like the existing anatomical states. The dominant signs are those of hardening of tissue, with dilated tubes.

621. The local symptoms may, according to circumstances, wear the character of those of asthma, or of phthisis.

The constitutional symptoms are, generally speaking, not severe in the direct ratio of the amount of local mischief,—whence

* Report on Preventible Diseases, Brit. Med. Journal, Feb. 1868

a broad distinction between these affections and tuberculous consumption. The knowledge of the cause also aids in the diagnosis: though, on the other hand, it may tend to deceive, as these artisans are very certainly not exempted from phthisis.

622. It seems certain that knife-grinders, like all other artisans, polishers of iron and steel, suffer less from the metallic particles, than from the stone grit, inhaled. Obviously the grinding-stone should be kept as wet as allowable, to prevent the formation of dust as far as possible. Various mechanical contrivances have been invented for preventing either kind of particle entering the chest. Abraham's magnetic mouthpiece attracts metallic particles, but has no effect on the stone-grit. Dr. C. Holland's revolving fan, acting by a strong current upon the spot where the metallic dust and stone-grit are formed, seems to be more successful. An extempore respirator of cotton-wool would doubtless be serviceable. But the workpeople, sometimes from laziness or stolid indifference, sometimes from real evils attached to their use, prove unwilling to steadily trouble themselves with any of these contrivances. And in point of fact, the only real cure comes of change of occupation.

(II.)—CARBONACEOUS BRONCHITIS, OR BLACK PHTHISIS.

623. The most interesting variety of bronchitis of the present class is undoubtedly that observed in miners, and described under the title of Black Phtthisis,* and anthracosis.†

624. Originally observed in coal-miners, this affection was long supposed to be due solely to inhalation of coal-dust. Mr. Graham‡ was the first, as I believe, to show that, common to miners of all kinds, it really depended essentially on inhalation of the smoke from the lamps suspended from the miners' heads, while at work. To this cause Dr. Makellar adds the inhalation, in confined mines, both of the carbonic acid generated in the pit, and of that expired by the labourers themselves; and also the inspiration of carbon and carburetted gases, which float in the heated air after explosions of gunpowder required in the works. Doubtless, too, in coal mines inhalation of the black dust plays some small part in producing the disease.

625. Anatomically it is found the carbon accumulates in the

* Makellar, Edinb. Monthly Journal of Med. Science, 1846. To this very complete monograph I beg to refer for further information.

† Warrington, Begbie.

‡ Edinb. Med. and Surg. Journal, vol. xlii.

minute bronchial tubes, and obstructs these and the connected cells. Either irritation sets up in the parenchyma around; softening sooner or later occurs; the pulmonary tissue breaks up, and cavities, eventually of large size, from union of adjoining smaller ones, form: or, on the other hand, chronic peri-bronchial and interstitial cirrhotic infiltration of the firmest type is established.

626. Not only does this form of irritation not predispose to tubercle, but the carbonaceous disease seems actually to antagonise genuine phthisis. Dr. Makellar not only never found tubercle in the bodies of colliers cut off by the disease, but ascertained that many of the number had relations, not miners, destroyed by pulmonary consumption.

627. One of the most curious facts proved by this disease is, that the lung itself produces carbon on a large scale, once the impulse has been given by the free inhalation of lamp-black. Years after the occupation of mining has been relinquished, the amount of lung involved by carbonaceous deposit continues to increase. The lung becomes, to use the emphatic expression of Dr. Makellar, "a manufactory of lamp-black."

628. The carbonaceous matter in advanced cases impregnates the blood: this resembles thick brownish ink, flows sluggishly, and but feebly stimulates the heart and system at large.

629. *Symptoms.*—(a.) In the early period of the disease, incessant dry cough, and other bronchitic symptoms attract attention, with slight palpitation and acceleration of pulse. The respiration-sounds are loud: dry bronchial rhonchi abound. The percussion is as yet unaltered.

(b.) At a later, or second, stage, when softening has commenced, most distressing cough, expectoration of black matter,* and dull percussion sound, without bronchial respiration, may be substantiated.

(c.) In the third stage signs of excavation ensue.

Rapidly decreasing frequency of pulse and systemic exhaustion, are the most striking general symptoms. The course of the affection is essentially chronic,—lasting generally some years.

In some rare instances the disease closely simulates true phthisis in its symptomatology. There may be cough and expectoration, dyspnoea, thoracic pain, colliquative sweats, and great emaciation; but in a case of this stamp, seen by Dr. Makellar, a

* In one case Dr. Makellar continued to collect weekly (for some weeks) nearly two ounces of carbon, precipitating in water from the associated bronchial secretion.

broad distinction was drawn by the fact that the pulse beat but thirty-six per minute.

630. *Treatment*.—Removal from the occupation will save life, if the change be effected, while the disease has not passed the earliest stage.

631. The attempt to relieve urgent symptoms by venesection has proved a signal failure—such loss of blood producing “general debility, and rapid sinking.”

632. The most important prophylactic measure consists in free ventilation of the pits. The use of some other lighting material than oil is also called for. There is reliable testimony that where these precautions are taken, especially the former, the disease is unknown.

C.—HAY-ASTHMA.

633. A singular variety of naso-pulmonary catarrh, distinctly traceable, despite contradictory assertions, to inhaling the aroma of the sweet-smelling spring grass and hay (*Anthoxanthum odoratum*), is known under the name of hay-asthma, hay-fever, or summer catarrh. The complaint occurs at the periods of hay-making, or when the odour of parched grass is powerful; and is of exceedingly rare occurrence. The susceptibility to these emanations, indeed, constitutes a very remarkable example of peculiar and unalterable nervous idiosyncrasy. Persons who have once suffered, invariably have a return of the disease, if exposed, even in a slight degree, to the specific cause. The air wafted from Hampstead to central London in the hay-making season is quite enough to produce the habitual seizure in cases known to me. Even old dry hay will affect some people.

Besides, the perfumes of various flowers and the powder of *ipæacuanha* produce, in persons peculiarly constituted, symptoms very closely similar. Even a walk through a hot-house will cause an attack in some persons.

634. *Cause*.—(a.) Hay-fever occurs in children and in adults, and appears to be usually more frequent in males than in females. I have ascertained by frequent questionings that working hay-makers are *very* rarely affected: whether this fact (a most singular one) has been utilized as an argument by those who vainly try to prove hay-fever altogether a myth, I am unable to say.

(b.) Special sensitiveness of the nerves, supplying the whole mucous tract implicated, must be accepted as a kind of diathetic basis of the complaint. Whether the irritant effect of the pollen

and hay-emanations is mechanical, and dependent on the actual presence of invisible minute molecules, or chemical, is yet a moot point. The benzoic acid found in several of the noxious grasses has been hypothetically credited by some writers with the production of the disease.

635. It is incorrect to term the disease bronchitis, though for convenience sake classed therewith; the entire naso-pulmonary tract is, in truth, implicated. Mid-frontal cephalagia, violent and continued sneezing, irritation in the eyes, ears, and nostrils, with redness, swelling and flux; soreness and prickling sensations in the mouth and throat; dyspnoea, sometimes paroxysmally severe, indeed genuinely asthmatical; post-sternal oppression and rawness; dry, harassing cough; and, towards the close of a seizure, thin mucous and watery expectoration, are the symptoms of the complaint.

636. If the affection be left to itself, its usual duration ranges from two to five weeks; but even in cases carefully tended, the symptoms may persist for a month. The annual return of the disease is one of its essential characters.

637. The most effectual method, the habitual sufferer can adopt for preventing an attack, consists in removing at the proper season to the sea-side,—in getting out of reach of the odours of grass and hay. But so exquisitely sensitive to such sensations are some individuals, that a land-wind, blowing for a few hours only, will bring on an attack even at the sea-shore. Once the complaint is established, total abstraction of the existing cause will commonly, but by no means invariably and certainly, put an immediate term to the seizure; I have had a very precise narrative of a case, in which the patient retained his symptoms during a passage across the Atlantic.

638. Several years since, a course of sulphate of iron and quinine and the use of the shower-bath, directed by Dr. Gordon,* removed the complaint in two persons who had been its annual victims for fifteen or twenty years. The combination has since perpetually failed in the hands of others.

639. During the seizure, small, frequently repeated doses of prussic acid, and the æthereal tincture of lobelia inflata, with d'Espic's cigarettes, or those of datura tatula, are useful remedies, when spasm of the tubes form an element of the disease. If the spasm be very severe and protracted, chloroform-inhalation may be used. Dr. Elliotson believed he had observed benefit accrue from breath-

* Medical Gazette, vol. iv.

ing an atmosphere with chlorine diffused through it,—saucers of the chlorides being placed in the rooms of the patient's house, and the face washed with a weak chlorinated solution. I am disposed strongly to recommend a trial of inhalations of creasote and of carbolic acid, several times daily, from their remarkably satisfactory effects in some instances.

640. Are there any drugs having specific influence on the complaint? Bromide of potassium, hydrochlorate of ammonia, and belladonna have been groundlessly assigned this power. Dr. Watson recommends arsenic; Mr. Hamerton and Dr. Greain *nux vomica*. I do not desire to question the occasional utility of either: but I have known arsenic fail egregiously, where it was administered under circumstances peculiarly favourable to fair trial; and I am informed by a friend, who has largely used it, that *nux vomica* cannot be depended upon. There can be no doubt that all general tonic measures calculated to invigorate the system, and lessen the special susceptibility of the mucous membranes, as advised by Dr. Gordon, are rationally indicated. They will, however, prove wholly incapable, in a good proportion of cases, of averting the returns of the disease.

641. Though so rare an affection, and in no wise dangerous to life, the literature of hay-fever is very copious, as may be seen by reference to the elaborate monograph of Dr. P. Phœbus.*

D.—BRONCHITIS APPERTAINING TO ACUTE SPECIFIC DISEASES.

(1.)—TYPHOID BRONCHITIS.

642. Symptoms of bronchitic character occur in the great majority of cases of true Typhoid Fever.

643. As this form of secondary inflammation of the tubes is commonly unattended with intra-thoracic pain, or accelerated breathing, as it entails no change of temperature, and as it causes little cough and little or no expectoration, the result is, that generally-diffused dry and moist bronchial rhonchi, especially the former, supply the sole evidences of its presence.

The actual inflammation, which is always bilateral, is evidently very slight. The disproportion between the amount of rhonchi on the one hand, and of the cough and dyspœa on the other, might, according to M. Louis,† be fairly used as an element of diagnosis, and argue for the secondary character of the existing bronchitis.

* Der Typische Frûhsommer Katarrh. Gießen, 1862.

† Affection Typhoïde, vol. ii. p. 283. 1^{re} édit., 1829.

644. In this ordinary bronchitis of typhoid fever the state of the tubes is unimportant in regard to treatment. But in comparatively rare instances, severe bronchitis, with extensively diffused fine bubbling rhonchus, accelerated breathing, and some amount of expectoration, occurs, throwing into the shade the more ordinary characters of the fever. Counter-irritation and soothing, or eventually stimulant, expectorants are, however, solely required, even in this severer class of bronchitic cases. There is no special tendency to accumulation of secretion in the tubes,—in point of fact the surfaces relatively secrete but little.

645. The precise researches of Sir W. Jenner show that there is less tendency to bronchitis in Typhus, and still less in Relapsing, than in Typhoid, fever.

(II.)—SYPHILITIC BRONCHITIS.

646. As far as my information goes, the credit of originally showing that the virus of syphilis may affect the bronchial mucous membrane belongs to Drs. Graves and Stokes, followed by Dr. Munk. That the discovery should have been reserved for the present day seems singular, seeing that the intrinsic tendency of morbid actions of all sorts to creep along *mucous* surfaces—and the throat and laryngeal symptoms were obvious to sight—was a favourite piece of doctrine with our forefathers.

647. Bronchitis may of course occur at any period of syphilis, from the moment of inoculation to the disappearance of its last tertiary phenomena. But such bronchitis may be of purely extrinsic origin, and utterly independent of syphilitic influence: a man may catch a cold, though he has got a chancre or its effects. What evidence, then, is there that the virus ever really acts as an irritant of the bronchial mucous surface, after the fashion it seizes upon that of the mouth, pharynx, larynx, and anus?

Anatomical evidence is wanting. I have never seen condylomata of the bronchial surface after death such as those that may during life be descried in the pharynx in secondary syphilis. Neither is there anything that I know of in the symptoms or in the physical signs distinctive of origin in venereal taint. If then, evidence is to be found, it must be in peculiarities of course of the disease and in the results of treatment. This evidence will appear in the following short account of observed facts.

648. Bronchitis presumedly syphilitic, may occur: (a) During the incubation-stage of the secondary implication of the skin and mouth, or just at the time of the cutaneous outbreak; (b) at any

moment during the progress of the secondary stage; (c) during the period, short or long, intervening between the cessation of positive secondary symptoms and the appearance of the tertiary class; and (d) during the tertiary period. Now it is a first fact worth notice that bronchitis occurring in connection with the secondary stage is, like acknowledged "secondary symptoms," invariably *bilateral*; whereas, as I have occasionally seen where indubitable tertiary effects were present,—in a lung for example,—the bronchitis, like external tertiary changes, may be *unilateral*: of the period c I can say nothing in this point of view.

649. During the periods *a* and *b*, bronchitis may be associated with, or stand in a sort of antagonistic relationship to, the cutaneous affection. The latter is both the more common and the more characteristic event.

Thus at a variable period after inoculation (not extending however beyond the limit of the possible supervention of the secondary stage), pyrexia, and well marked bronchial irritation occur,—these may arise as forerunners, by three or four days, of the cutaneous eruption, and upon the establishment of this disappear altogether or undergo great mitigation. And conversely, if a syphilitic eruption suddenly disappear, spontaneously or through treatment, bronchitis may ensue. The strong resemblance, in the course run by such bronchitis, to that noticed in the bronchial irritation attending certain of the exanthemata, was long since justly insisted upon by Dr. Stokes. The influence of a specific agent cannot be overlooked or gainsaid.

As a rule in both kinds of case, the symptoms are mild, and the bronchial discharge limited in amount; but the very reverse is occasionally observed,—dyspnoea, *inter alia*, being intense.

650. Again, during the periods *b*, *c*, and *d*, the patient may have bronchitis as a chronic persistent state; he may cough, have copious sero-purulent and muco-purulent expectoration, night perspirations, and hectic fever, while he rapidly loses flesh and strength. The bronchitis is *bilateral*, and more or less diffused, not limited to the apices, nor on the other hand to the bases.

651. Now here is assuredly a combination of local and general conditions calculated to create strong suspicion of the existence of phthisis. How are the cases to be distinguished? By the total want of accordance between the physical signs and the constitutional symptoms; the patient with syphilitic bronchitis has neither consolidation-signs, nor, *a fortiori*, the evidences of excavation. But there is a curious source of difficulty, which some-

times starts up in these cases, and renders doubt imperative: the infra-clavicular ribs and clavicle thicken from periosteitis, and produce dulness under percussion, which cannot with positiveness be distinguished from that of tubercle within the lung. Here the observer must wait for events to clear up the diagnosis. Thus a female was admitted under my care in 1846, labouring under secondary and tertiary syphilis, and cancer of the rectum; in addition she had bronchitis, and very slight percussion-dulness, with harsh respiration, under the right clavicle: but as the subjacent bones were obviously thickened, I abstained from giving any positive opinion as to the existence of consolidation of the lung. The chest-symptoms totally disappeared for the time under treatment. I have frequently seen the patient since; consolidation-signs, growing at each interval more marked, had become positive at both apices when I last (winter of 1850) saw her.*

652. I have seen chronic unilateral bronchitis in the tertiary stage, but only in connection with evidences of syphilitic deposit in the lung, and therefore refer to the account of that form of deposit for any observations I may have to make.

653. One of the strongest evidences of the really syphilitic character of the bronchitis we have been discussing, is to be found in the results of treatment. Especially in the chronic variety, mercury sometimes produces most striking good. I have however, as a rule, trusted to iodide of potassium with dry ioduretted inhalations,—with, where this has been possible, a course of the waters of Aix-la-Chapelle.

R.—DIATHETIC BRONCHITIS.

654. Diathetic bronchitis, or that dependent on blood-diseases, is characterised as a rule by its pertinacity, and its resistance to, and unsuitableness for, ordinary antiphlogistic treatment. The measures adapted for its relief and cure are substantially those most appropriate for the existing diathesis. Need it be said that bleeding and antimony are not the means by which scorbutic or purpuric bronchitis is most effectually to be controlled: that, where jaundice or glycohaemia exist, those agents are inappropriate? Even in gouty and rheumatic bronchitis and in that attending Bright's disease, the antiphlogistic plan is of subsidiary importance, and only applicable where the inflammatory action is of extreme violence and assumes the significance belonging to an idiopathic attack.

* Swedley, U. C. H., Females, vol. i. p. 143 (1846).

655. In bronchitis of hæmic origin the sputa very constantly contain some of the *materies morbi* circulating with the blood. Thus in icteric bronchitis the colouring matter of the bile often tinges the expectoration,—sometimes deeply enough to be visible to the naked eye, sometimes so slightly as to require micro-chemical examination for its discovery. Blood-discs escape with the secretion of purpuric and scorbutic bronchitis; sugar has been discovered in that of the glyco-hæmic or diabetic variety;* and either undecomposed urea, or certain of the products of its decomposition, may appear in the expectoration of uræmic bronchitis.

656. We must content ourselves with these general indications of the peculiarities of bronchitis dependent on blood-diseases.

F.—BRONCHITIS SECONDARY TO CHEST DISEASES.

657. The clinical features of bronchitis thus produced will be sufficiently described with the various pulmonary and cardiac diseases originating it.

II.—ORGANIC CHANGES OF THE BRONCHI.

(1)—NARROWING AND OBLITERATION OF THE BRONCHI.

658. Narrowing and obliteration of the bronchi, a not uncommon phenomenon in tubes of very small calibre, becomes rarer and rarer in the direct ratio of their increase in width; still obliteration, even of the main trunk, has occasionally been witnessed.

659. Obliteration sometimes exists in the same tube as globular dilatation,—immediately beyond this on the side furthestmost from the trachea.

660. The obstruction may depend on *intrinsic* or *extrinsic* causes. Among the former rank thickening of the mucous membrane; stagnation of secretions, especially of the plastic kind (under both these circumstances the obstruction is of acute and inflammatory mechanism); great thickening of the bronchial walls with induration-matter or fibro-plastic substance; and, lastly, accumulation of cancer or tubercle in their interior. Among the latter class of causes, acting by *extrinsic* pressure, appear adjacent emphysema, adjacent tuberculous deposit, plastic contractile exudation-matter, infiltrated cancer or chronic solid pleural formations. Enlarged bronchial glands, aortic aneurisms, and

* Francis, Lond. Med. Gaz., Feb. 1847

mediastinal tumors frequently produce partial, and have sometimes effected complete, closure of a main trunk by pressure.

661. If serious obstruction of a large bronchus, by its own secretions, occur suddenly, or even with notable celerity, dyspnoea, proportional to the size of the implicated tube, follows. And as this accident has chiefly occurred in cases of bronchitis either capillary [583] or plastic [600], where the efficient breathing surface had already been seriously diminished, risk of fatal asphyxia is incurred, unless the patient retains strength sufficient to enable him to expectorate the stagnating matters: the relief experienced after such expectoration is almost assimilable to that following tracheotomy for obstructed larynx.

662. But if the obstruction be on a small scale, or if a large tube suffer only from slow, gradually increasing obstruction, there will be no positive subjective or objective symptoms to indicate the occurrence. Such dyspnoea, as is really dependent on obstruction of the kind, appears explicable by other conditions; and neither cough, nor pain in the chest, to an amount unusual to the patient, are induced.

663. The physical signs may or may not be satisfactory. Obstruction of the main tube entails collapse of the entire connected lung, as is strikingly shown in one of Carswell's published drawings; * while obstruction of minor tubes, as insisted on by Dr. Stokes, produces local and limited collapse,—the surface of the lung in the affected parts appearing sunken in below the plane of the surrounding pleura.

664. *Physical signs.*—Now, in both these varieties, percussion-dulness, proportional to the superficial area and depth of the collapse, might be expected to exist. But, in the local variety, emphysema tends to spring up on the confines of the collapsed spots, and give rise to its own special exaggerated resonance. While, in the case of serious reduction of calibre of the main tube by tumor or aneurism, I have not actually ascertained the reality of the impaired resonance theoretically to be expected: but, in truth, there are here many conflicting elements at work. On the other hand, I have found, and been aided in diagnosis by the fact, that the patient proves incapable by the greatest inspiratory effort of extending the area of pulmonary percussion-sound.

The respiration is weakened, or, it may be, almost suppressed, and harsh. Sonoro-sibilant rhonchi are audible.

* PATHOLOGICAL ANATOMY. Fasc. Atrophy, pl. iv. fig. 3. The lungs are those of a monkey; the cause of obstruction, extensively tuberculed bronchial glands. Atrophy of the pulmonary substance from inaction would doubtless ensue after a time.

665. The main interest, in the present state of knowledge, of obstruction of a large bronchus, arises from the light it may throw on the diagnosis of thoracic aneurism and tumor.

666. The treatment of the affection is altogether that of the disease of which it is a sequence or effect.

(II.)—DILATATION OF THE BRONCHI.

667. Although we have no evidence that dilatation of the bronchi ever occurs as a primary condition of those tubes, and though, even as a secondary and consecutive change, it is, on the whole, a rare affection, still its study is of very considerable importance. For it appears in association with grave forms of pulmonary disorder, increases the danger of these, modifies their symptoms and signs, and frequently creates difficulty in their diagnosis.

668. *Anatomical characters.*—Dilated bronchi assume three different forms, *globular*, *uniform*, and *nodulated*.

669. (a) In the *globular* variety the dilatation is of rounded form, varying in size from a small nut to a large walnut, commonly communicating, on the tracheal side, with a portion of tube either of extremely or slightly widened calibre; while on the pulmonary side the continuity of the tube is lost, either from excessive narrowing or actual obliteration.

The walls of such dilated portions of tube, commonly thick, and exhibiting the several characters assigned to tubes affected with chronic bronchitis [598] are, on the contrary, in rare instances thin and almost transparent.

They may be perfectly empty. But they commonly contain fluid, consisting of muco-pus, or very pure pus in small quantity, —the latter sometimes peculiarly fetid.

670. The anatomical distinction of a globularly dilated portion of bronchus from a tuberculous cavity is commonly easy. The broken, irregular, bridled surface of the latter; its investment with patches, more or less extensive, of exudation; the non-continuity of its walls with those of connected bronchial tubes; the irregularity of its form; the consolidation of the surrounding tissue, all contrast strongly with the converse conditions in a globularly dilated portion of tube. But in certain cases these marks of distinction may fail; a tuberculous cavity may have a perfectly even surface, almost perfectly globular shape, and the tissue around may be normal in consistence.* Under such circumstances the detection

* Facts, all of them, illustrated by the case of Denet, U. C. H., Males, vol. xiv. p. 255.

or non-detection of the microscopical elements of bronchial texture can alone settle the question. Aid may be derived from the presence of tubercle in other parts of the lung; * and also in the wall-structure, which is the subject of debate.

671. Globular dilatations are generally few in number,—but one or two specimens in one or both lungs: the number may be greater, however. The surrounding tissue is either slightly condensed by pressure, hardened by chronic pneumonia, rarefied by emphysema, or perfectly natural.

672. (b) In the *uniform* dilatation a considerable number of bronchi is generally involved,—the tubes, pretty evenly widened, after the fashion of the fingers of a glove (sometimes the widening actually increases at each remove from the main bronchus), abruptly terminate at variable distances from the periphery of the lung. The walls are invariably thick, sometimes cartilaginous. This is the form especially associated with interstitial and parenchymatous cirrhotic infiltration.

673. (c) The *nodular* variety is a compound of the two others,—general dilatation of the tubes with local slight globular fulnesses from place to place.

674. *Mechanism*.—As far as I am aware, M. Andral stands almost alone in the opinion, that dilatation of the bronchi may be a primary morbid state depending on a form of hypertrophy, and antecedent to cough or other bronchial disturbance of function.† If such mechanism be ever real, its occurrence must at least be infinitely rare. Under ordinary circumstances in acute (and yet more in chronic) cases the elasticity of the bronchial tubes is destroyed, and their muscular contractility impaired [589] by inflammation; they hence yield *quasi*-passively to the distending influence of cough in expiration and of accumulated secretions. If there be much indurated tissue around the tubes, the deficiency of elastic reaction in the indurated substance facilitates the occurrence of dilatation (*vide* CIRRHOSIS OF THE LUNG).

675. Though commonly of slow, dilatation may be of rapid, development. In capillary bronchitis, both of the primary variety and in that attending influenza, the change is accomplished in the course of a week or two. And even where no such active influence

* Some writers speak of considerable quantities of tuberculous matter being occasionally found in dilated bronchi. I cannot help believing they have been misled by genuine tuberculous excavations of the exceptional characters just described.

† M. Louis adopts a somewhat analogous view, that the dilatation is frequently the result of a force, such as pressure, because the development of hollow organs generally, in virtue of which they widen without the intervention of mechanical causes of any kind. (Mém. de la Soc. Méd. d'Obs., t. i. p. 254.)

is apparently at work, general dilatation of the tubes may certainly be effected in the course of a month.*

676. The conditions of disease to which dilated bronchi may form an adjunct are: bronchitis acute and chronic; emphysema; constriction of the tubes themselves; acute and chronic pneumonia; cirrhosis of the lung; phthisis; cancer; and chronic pleurisy with retracted side.

677. *Clinical history.*—In the present place I shall consider the disease clinically, solely as an attendant on chronic bronchitis,—in its other associations it will be found described with the primary diseases concerned.

678. *Physical signs.*—The bulk of a lung having a few of its tubes globularly, or many of them uniformly, dilated, may not be appreciably changed. Coexisting air-distension and emphysema on the one hand are counter-balanced on the other by condensation or collapse of lung-substance. If such condensation exist to a notable amount, instead of any tendency to local bulging, there may be distinct depression of the corresponding chest-surface. General falling in of the side is never observed in this form of dilated tubes.

In the majority of cases the vocal fremitus is increased in intensity, and may be greatly so; rhonchal fremitus, likewise, is sometimes very strong.

I have not actually met with dilatation of the tubes, or even of a single tube, if considerable in amount, without morbid percussion-note. Either there is high-pitched toneless sound [Type I. 195], commensurate with the extent of attendant condensation; or some form of tubular resonance. In certain published cases, where the resonance is alleged to have been "clear," (and, by intended inference, healthy,) the so-called clearness was doubtless of the latter unnatural quality; I have known it very purely amphoric. Still, were a globular dilatation very deep-seated, I can conceive the percussion-results being wholly unaffected.

The respiratory sounds are simply harsh, or high-pitched and bronchial, or, more commonly, of diffused blowing type. When one or more tubes are largely dilated, the respiration may be loud, ringing, and distinctly cavernous in quality; and, under the same circumstances, the ordinary dry or moist bronchial rhonchi may be superseded by the dry or moist cavernous varieties. The vocal resonance varies: totally deficient in some cases, temporarily, or, to all appearance, persistently; in others, it is strongly broncho-

* See a most conclusive case in Louis, loc. cit. p. 246.

phonic, and may even assume pectoriloquous quality.* The heart's sounds may be transmitted with undue intensity through the seat of dilatation.

679. *Symptoms.*—The addition of dilatation of the tubes to chronic inflammation of their mucous membrane, seriously increases the gravity of the latter disease. Here it is that the expectoration is most abundant, most foetid, most opaque and solid, most thoroughly purulent, and hence most wasting to the system. The aëration of the blood is rendered difficult by the altered structure of the mucous membrane; hence lividity of the face commonly exists to a marked amount. The long continuance of the disease tends to produce enlargement and thickening of the right ventricle, but I have never observed hæmoptysis unless where there was co-existent mitral disease or pulmonary tubercle. Some degree of thermometric rise and night-sweating occasionally occur; and the weight of the individual commonly falls very considerably below the standard of health.

In some cases (where the dilatation especially is seated at some distance from the main bronchus) stagnation of the contents may hold on for many days, a sort of periodical discharge taking place with intense cough and agonizing dyspnoea. Under these circumstances, the fluid may be of intense foetor, and the expired air also [592]. This state of things may co-exist with but slight constitutional suffering: I have actually seen this, but I presume such a course of events must be excessively rare.

680. *Diagnosis.*—The more common form of symptomatic condition, far from dissimilar to that of phthisis, may co-exist with physical signs, so like those of excavation, that it is next to impossible sometimes to affirm with certainty whether a given case be one of tubercle with cavity or cavities, or of globularly dilated bronchus or bronchi with surrounding induration.† The distinction may, however, in many instances, be established by means of the following marks of difference: (a.) The percussion-sound is invariably morbid above the clavicle in cases of phthisis of the ordinary class; not necessarily so in those of dilated bronchi; hence natural resonance in this spot will argue strongly for the latter disease; but hard, toneless or tubular note will not decide the point against it.‡ Generally speaking, too, want of tone is more absolute and

* Osmond, U. C. H., *Males*, vol. iv. p. 341, &c.

† Case lxx. of *Louis*, *Phthisis* 2eme ed. p. 662, is sufficient proof of this.

‡ Among Carswell's unpublished drawings (U. C. Museum) is one of a globularly dilated bronchus, that must have given tubular percussion note above the clavicle.

extensive below the clavicle in phthisis than in the other affection; for, if the bronchi be largely dilated and surrounded with conch induration-matter, the resonance becomes tubular or amphoric. (*b.*) The signs of tuberculous excavation are found at the apex: those of dilated bronchus generally lower,—say at the union of the upper with the middle third of the chest. (*c.*) When tubercle has reached the excavation-stage, flattening of the infra-clavicular region is, relatively to that of the side generally, more marked than in bronchial dilatation. (*d.*) I have never known hæmoptysis to any notable amount produced by chronic bronchitis with dilatation alone;—if hæmoptysis exist, and there be no evidence of mitral disease, the inference that the excavation is tuberculous becomes matter of necessity. (*e.*) Extreme emaciation, profuse night-sweats, and obstinate diarrhoea, do not, as far as I have seen, come of the bronchial disease alone: all three may, however, be wanting in phthisis. (*f.*) The course of the physical signs will avail us also, if the case continue for a time under observation. In phthisis the signs are, as a rule, constantly increasing in degree and extent; in bronchial dilatation, they may remain for months unaltered in both these respects: dulness under percussion, as remarked by Dr. Stokes, precedes the signs of cavity in phthisis, and does not occur till after them in bronchial dilatation;—to the latter clause, however, I have seen exceptions.

681. In the remarkable case, anatomically considered, a moment since referred to [670], the diagnosis, balancing between phthisical excavation and dilated bronchi, inclined to the latter, because the percussion-tone was very slightly changed in character. Tuberculous cavities are surrounded, in truth, as a rule, by indurated tissue, that deeply modifies the percussion-note. But in the instance in question, the tissue adjoining the tuberculous excavations actually present turned out to be normal,—and the distinction of their nature proved almost as difficult after death as during life. And so, paradoxically enough, the clinical error distinctly deposed in favour of the precision of physical diagnosis.

682. I once met with a case* where the conditions of bronchial dilatation were sufficiently defined to justify the diagnosis of that state,—and where, after death, both bronchial dilatation and a small recent growing tuberculous excavation were found almost side by side. This compound condition is, probably, beyond the reach of diagnosis.

* Ann Harrison, U. C. H., Jan. 22, 1848.

683. And, in point of fact, the association of dilated bronchi and tuberculisation of the lung is by no means uncommon, due admission being made for the rarity, absolutely speaking, of the former. Tuberculous excavations and gray granulations may exist in the same lobe with globularly dilated bronchi;* or the former may affect the upper, the latter pervade the lower, lobe.† Under these circumstances the dilatations might readily be taken for smooth-walled excavations [670].

684. The factor of the sputa often suggests the idea of *gangrene of the lung*; nor is the distinction, which is considered under the head of that disease, always so easy as might be wished.

685. *Prognosis*.—It has been conceded [598] that acute dilatation is probably curable: I know of no even seeming evidence of the curability of the chronic disease. The complaint may, however, endure for years.

686. *Treatment*.—The treatment is a combination of the local measures indicated in chronic bronchitis, and of the general appliances adapted to emaciating diseases, especially phthisis.

(III.)—TUBERCLE OF THE BRONCHI.

687. Tuberculous disease of the bronchi is limited to the finer tubes. The morbid deposit, as Carswell was the first to show, occasionally forms on the free surface of their mucous membrane: but he was in error in imagining this to be its essential seat in phthisis; and bronchial tuberculisation, as clinically distinguishable from that of the parenchyma, is unknown.

(IV.)—CANCER OF THE BRONCHI.

688. Primary cancer of the bronchi, or cancer affecting these tubes independently of similar disease in the lungs or mediastina, is not observed. But the following secondary forms of the disease present themselves in clinical practice.

(1.) In certain cases of cancerous infiltration and ulceration of the pulmonary tissue, those morbid processes spread to, and cause the destruction of, the bronchial tubes involved. (2.) Perforation of a bronchus by a portion of actively growing tumor situated about the root of the lung, has occurred in rare instances; the perforating cancer vegetates freely in the interior of the tube, into which it has made its way.‡ (3.) More rarely still, a detached

* Osmond, U. C. H., loc. cit. p. 343.

† Marshall, U. C. H., *Medus*, vol. ix. p. 240.

‡ Jennings, U. C. H., *Females*, vol. xv. p. 65.

tumour forms in connexion with the mucous membrane of a bronchus, the lung being similarly diseased. (4.) Cancerous substance may be found *in transitu* outwards from a softening pulmonary mass; and portions of such substance of notable size may be expectorated during life [610].

689. All these forms of disease derive their main practical importance from their connexion with cancer of the pulmonary substance, and therefore require no further consideration in the present place.

(v.)—POLYPI OF THE BRONCHIL.

690. True pedunculated polypus, invested by mucous membrane, has in very rare instances been found in the bronchial tubes. The clinical history of such formations, as a matter of actual observation, is a blank.

SECTION IV.—DISEASES OF THE BRONCHIAL GLANDS.

I.—INFLAMMATION OF THE BRONCHIAL GLANDS.

691. Inflammation of the bronchial glands, anatomically characterised by enlargement, softness, redness, infiltration with exudation matter, and sometimes with pus, is a state very rarely observed. Such inflammation occasionally coexists with pneumonia.

692. Mediastinal abscess sometimes originates by inflammation in the substance of these glands; and as this is the only aspect under which I know anything of the affection clinically, I refer for further information to the brief account given in the section on Diseases of the Mediastina.

II.—TUBERCULISATION OF THE BRONCHIAL GLANDS, OR BRONCHIAL PHTHISIS.

693. Tuberculisation of the bronchial glands, an affection, in regard of clinical significance, almost confined to childhood, occurs commonly in the chronic, with infinite rarity in the acute, form.

(A.)—CHRONIC TUBERCULISATION.

694. All varieties of tuberculous deposit appear in these glands; the gray granulation is on the whole a rare, the yellowish mass, infiltrating the tissue, the most common, form. Deposition, as likewise subsequent softening, commences indifferently at all parts of the glands; the changes undergone by tubercle are the same

here as elsewhere: partial cretaceous transformation is not very uncommon.

Evacuation of softened, or even of crude, tuberculous matter may take place into the pulmonary substance, into the trachea, into a bronchus, or into the œsophagus. A permanent fistula is, thus, sometimes established, between the excavated gland, lined by an adventitious pseudo-mucous membrane, and the tube (Guersent); or, evacuation of the tuberculised substance of the gland having been completed, its thickened involucre becomes incorporated with, and fills up the opening in, the bronchial wall. Cretaceous matter may be expectorated from the interior of a bronchial gland through a fistulous communication with the trachea or a large bronchus.*

695. Tuberculised glands vary in size from the natural bulk to that of a walnut. A few only, or several, may be affected: in the latter case, those adjoining the bifurcation of the trachea may form an irregularly rounded lobulated mass, measuring, even in young children, two, and even more, inches in diameter. The glands adjoining the base of the heart, and those of the posterior mediastinum, undergo similar, though, generally speaking, less marked enlargement. Those seated in the substance of the lung rarely acquire large dimensions.

696. The natural thin cellular involucre of the glands thickens, as tuberculisation advances, and a more or less dense enclosing cyst, sometimes vascular on its inner aspect, is thus formed.

697. Tuberculised bronchial glands may produce, according to their bulk and the direction of their growth, more or less marked compression, and eventually perforation of various adjacent structures. A general description of these compressions and perforations will be found in Section viii. Part I. (Pressure-Signs), and in Section x. Part II. (Diseases of the Mediastina).

698. An excavated bronchial gland, sunk deeply into the lung-substance, simulates, and has doubtless often passed for, a true pulmonary cavity,—a fact, it would appear, first pointed out by Rilliet and Barthéz.

699. Tuberculisation of the bronchial glands is either associated, or not, with pulmonary tubercle. In the former, by far the more common case, the bronchial disease may be the chief evidence of the diathesis, or be of altogether secondary importance. In point

* Carswell's Illustrations, Tubercle, pl. iv. fig. 4. Perforation is more common of medium-sized, than of the larger, bronchi, or of the trachea.

of time the bronchial glands may be affected prior to, or subsequent to, the lungs, whether the clinical importance of the glandular affection be trivial or most serious. The cervical, inguinal, and mesenteric glands are in some cases tuberculised.

700. The bronchial glands may be greatly enlarged by mere increase of substance, or by infiltrated exudation-matter, and contain not the smallest particle of tubercle, while the lungs are highly tuberculised, and the child is clinically phthisical.*

701. The *symptoms* and *signs* of bronchial phthisis are those of bronchitis, mediastinal tumour, and the tuberculous diathesis, variously and capriciously associated: the symptoms are, locally, irritative and mechanical, and, constitutionally, hectic.

702. The *symptoms of mechanical origin* are substantially the same as those of mediastinal tumour in general, and depend on pressure, traction, or perforation of the various parts enumerated in Section viii., Part I. Among the most important of these symptoms are swollen cervical veins, lividity and œdema of the face, neck, and upper part of the chest,—limited to one, or affecting both sides, according as either vena innominata, or the superior vena cava is compressed: I have never seen distinct œdema of the arm. Discharge of blood by the mouth or anus is rarely observed. Hæmoptysis, especially, occurs very seldom in children under the tenth or twelfth year: but the escape of blood into and from the pulmonary texture through pressure is, we have every reason to believe, of tolerably common occurrence; it is swallowed as it reaches the mouth. Spasmodic dysphagia from pressure on the œsophagus has occasionally been witnessed. Heaviness and stupor, from obstruction to the return of blood from the brain, are common; and pressure either on the trachea, bronchi, the eighth pair, or recurrent nerves, causes singular modifications of the voice, cough, and physical signs, to be presently described.

703. *Physical Signs*.—If the mass of tuberculised glands be large, and press sufficiently on the lower end of the trachea, or on both bronchi, to impede the entry of air, the lower lobes gradually collapse, the chest falls in latero-inferiorly on both sides, and the sternum and costal cartilages come forwards: the infra-mammary and infra-axillary regions expand imperfectly, the infra-clavicular in excess. If the main bronchus on one side only be obstructed, flattening of the surface will be limited to that side [663].

* The same relationship of a cancerous organ and its connected glands is not uncommonly witnessed.

704. The vocal fremitus is often in excess in the inter-scapular region.

705. The essential physical sign, however, is percussion-dulness between the scapulæ; taken simply, by far the most significant of the series. I have known the resonance greatly impaired in front from the base of the heart to the sternal notch,*—but this is rare. The percussion-note is highly tubular between the scapulæ in some cases. Where a main bronchus has been sufficiently pressed upon to induce general collapse of its communicating lung,† the side generally is deficient in tone, especially under broad percussion; but the want of resonance is not so marked as might *a priori* be expected.

706. The auscultation-signs vary widely under different circumstances. (*a.*) If there be sustained pressure on the trachea or large bronchi, sonoro-sibilant or liquid bronchial rhonchus, and weak, almost suppressed, respiration of intermittent type, and of unnatural but variable quality, are heard. At the same time laryngo-tracheal stridor and rattle may be audible at a distance. (*b.*) If there be no pressure, and the glands adhere closely both to the chest wall and the bronchi, high-pitched, hollow, bronchial respiration, large-sized, ringing, liquid rhonchi, and powerful quasi-pectoriloquous bronchophony are audible with varying perfection and steadiness. (*c.*) Lastly, if there be no pressure by the glands, and if no artificial medium of conduction between the tubes and the surface be formed by them, the auscultatory signs will be null, or those of simple bronchitis.

This statement of the auscultation-signs is given on the assumption that the child is not *pulmonarily* phthisical; if the lungs be themselves tuberculous, the signs are of course variously modified according to the stage and amount of parenchymatous tuberculation.

707. *Symptoms.*—(*a.*) *Local.*—The child affected with bronchial phthisis, lies, sits, or leans in all varieties of postures: orthopnoea is the rule in paroxysms of difficult breathing. Often there is no evidence of thoracic pain or tenderness; if there be marked local suffering, this depends on some superadded, generally pleuritic, irritation. Cough, an almost invariable symptom, may be totally devoid of significant character; or, hoarse, ringing, dry, occurring in fits resembling those of whooping-cough, but not accompanied with actual hoop, nor followed by ropy expectoration and sick-

* Case of S. T., ætatis 3, seen with Mr. C. Crosswell.

† Catwell's Elementary Illustrations, Atrophy, pl. iv. fig. 3.

ness, it may give clear indication of dependence on irritative pressure of the vagus or recurrent nerves. So, too, the voice and cry may retain their natural characters, or become hoarse, feeble, or even temporarily null. If expectoration occur (the rarity of which in the child need not be insisted on), the sputa are simply catarrhal, muco-epithelial, or purulent and non-sanguineous; in the adult, tuberculous matter in all stages of evolution may be expectorated, if a diseased gland open into the bronchial tubes. The respiration, varying between twenty and eighty per minute, may be steadily and uniformly shallow and laborious; or paroxysms of dyspnoea, sometimes coming on by night, accompanied with lividity of the face, anxious countenance, cold clammy perspiration, and all the phenomena of partial asphyxia, may supervene from time to time. In one case of this kind, in a child aged three years, the characters of the seizure were very much those of laryngismus stridulus. I have never seen actual convulsions.

(6.) *General.*—The general symptoms are usually at the outset without distinct significance. Failure of appetite and loss of flesh, general uneasiness, indicated by peevishness and ill-temper, with evening pyrexia, common to so many infantile affections, may either precede for some weeks all local chest-symptoms, or set in simultaneously with these. Eventually the constitutional state becomes that of pulmonary phthisis: hectic fever, with night perspirations (which rarely become extreme), loss of strength, colliquative diarrhoea, and excessive emaciation,—symptoms commonly referrible in part, however, to co-advancing general or pulmonary tuberculation.

708. The *course* of bronchial phthisis is generally remarkable for its irregularity, traceable, except in rare instances, to attacks of passing bronchitis.

709. The ordinary *mode of death* by gradual asthenia, is sometimes varied by accidental occurrences, such as tremendous hæmorrhage from perforation of the pulmonary artery, pneumothorax, or meningeal hæmorrhage: * (pneumo-thorax is not of necessity immediately fatal). Or intercurrent pneumonia or bronchitis abruptly brings life to a close; or the tuberculating process, translated to the meninges, or peritoneum, may kill by its effects

* I give this cause of death, of which I have not met with an example under the circumstances, on the authority of MM. Rilliet and Bartholoz. A singular case observed by Mr Edwards (*Assoc. Journal*, May, 1854) shows that death may occur from asphyxia, caused by the impaction in the larynx of an entire bronchial gland, that had made its way into the trachea.

in those localities, all pectoral symptoms having disappeared for some weeks before death.

710. *Diagnosis.*—The *direct* diagnosis of bronchial phthisis can only be made through the association of several of the local and mechanical symptoms with those of constitutional character, and in the majority of cases, the disease has far advanced, before such kind of diagnosis becomes possible. The method, more commonly guiding to the detection of the complaint, is *indirect*. Thus, if a scrofulous-looking child become feverish, and cough more or less steadily, and if the physical signs cannot be referred to bronchitis, or pulmonary phthisis, while there is no evidence of mesenteric or encephalic tuberculation, a strong suspicion may be entertained that the bronchial glands are the parts affected. The suspicion will be powerfully strengthened, if even trifling loss of resonance or tubular percussion-note can be detected between the scapulæ, and converted into certainty, if the cough become paroxysmal, and signs of venous pressure supervene. The auscultation-signs vary so much in different individuals, and in the same case even, that they are entitled to little confidence; still their very irregularity aids in excluding other diseases.

The paroxysmal attacks of cough simulate those of pertussis: but there is no true hoop, no glairy expectoration, no violent vomiting. the fits are of relatively short duration,—and if the paroxysmal character, which gives rise to the difficulty, exist, it will either from the first, or very early, be attended by some or other of the pressure-signs enumerated.

711. *Prognosis.*—The data for scientific prognosis are as yet wanting. It may, however, be affirmed, that the chances of recovery are directly as the certainty with which we can affirm the absence of tubercle in the lung.

712. *Treatment.* The treatment, being essentially that of pulmonary phthisis, need not here be dwelt upon. I would simply observe that from the free internal use of cod-liver oil, and of ioduretted applications between the shoulders, with careful hygienic management, complete restoration to health, combined with physical evidence of diminished bulk of the bronchial glands, may sometimes be accomplished. One of the most striking instances I have met with of such recovery occurred many years ago among the out-patients of University College Hospital. Two children, aged about five and seven years, who had just lost their mother from phthisis, were brought to the hospital, one in arms, by their father. Both were in the last stage of emaciation, had mesenteric

disease, all the rational symptoms of phthisis, and marked inter-scapular dulness under percussion; they rapidly recovered flesh and strength, and when they ceased to attend, had not only to a great extent lost all chest-symptoms, but had become normally resonant, or very nearly so, between the shoulders.

(B).—ACUTE TUBERCULISATION.

713. Acute bronchial phthisis is excessively rare. Rilliet and Barthez have, however, recorded one seemingly unquestionable case, in which death took place in six weeks from the first appearance of illness. Paroxysmal cough, occurring five or six times daily was the first symptom noticed; the pulse and respiration were excessively frequent; progressive emaciation, and copious perspirations proved the deepness of the constitutional suffering. Not a particle of tubercle was found in the lungs; and a single crude miliary tubercle in the brain, without surrounding softness, was the sole specimen of that product in the body, in addition to the deposit in the bronchial glands.

III.—CIRRHOSIS OF THE BRONCHIAL GLANDS.

714. In cases of pulmonary cirrhosis the bronchial glands may be infiltrated with induration-matter, like the lung itself. The practical bearings of the subject are elsewhere considered [CIRRHOSIS OF THE LUNG].

IV.—CANCER OF THE BRONCHIAL GLANDS.

715. Cancer of the lungs is not uncommonly associated with similar disease in the bronchial glands. Mediastinal cancerous growths sometimes distinctly originate in these structures,—and the disease may, as far as the chest is concerned, be demonstrably limited to them, both the lung and mediastinal cellular tissue escaping.

716. Cancerous bronchial glands, unless of sufficient bulk to produce pressure-signs, are beyond our means of discovery: when producing such signs their diagnosis becomes that of mediastinal tumor.

SECTION V.—DISEASES OF THE PLEURA.

I.—HÆMOTHORAX.

717. Pleural hæmorrhage, or hæmothorax, is in the majority of cases *traumatic*, and results from wounds or violent contusions of

the walls of the chest, and fractures of the ribs, involving the tissue of the lungs. In some instances injury to an intercostal artery in the operation for empyema has caused serious hæmothorax. But it is not very rare as a *non-traumatic* state. Thus the fluid of pleurisy contains blood in considerable quantities in some cases; but no difference is thereby impressed on the physical signs, or (notwithstanding the opinion of Laennec to the contrary) perceptibly on the local symptoms or progress of the disease. In various blood-diseases with hæmorrhagic tendency, as scorbutus and purpura, if hydrothorax occur, the serous pleural effusion is more or less stained with blood. Carcinoma of the lung bursting into the pleura, or carcinoma of the pleura itself undergoing superficial ruptures,* or apoplexy of the lung, making its way through the pulmonary pleura, or rupture of an aneurism, may all produce hæmothorax.

718. Now, in all these *non-traumatic* cases, the effusion of blood is a secondary phenomenon: as far as I know, primary idiopathic hæmorrhage into the pleural sac, either active or passive, has not been observed. Two cases recorded by M. Andral,† and occasionally quoted as examples of such hæmorrhage, were obviously of secondary mechanism: pleurisy had long existed, and in both instances the patients were tuberculous.

719. The qualities of the blood vary,—brightly arterial, darkly venous, clotted or liquid. Besides, in some cases, the fluid, passing for blood, is merely serosity stained with hæmatin.

720. *Symptoms*.—Whether traumatic, or an effect of internal disease, the sole symptom clearly assignable to hæmothorax is laboured breathing,—the mechanical result of pressure on the lung and diaphragm. Various coexisting symptoms are the effects of the injury or internal disease, on which the hæmorrhage itself depends.

721. The *physical signs* of traumatic hæmothorax are loss of resonance and raised pitch of percussion-sound, enfeebled or annulled vocal fremitus, weak or suppressed respiration, absence of rhonchus, the vocal resonance being in a variable state, null, bronchophonic, or occasionally egophonic,—signs coming on suddenly without inflammation and under circumstances of injury to the chest.

722. *Diagnosis*.—In cases where extensive accumulation of blood occurs in the pleura from any of the internal diseases named, similar physical signs will be observed,—but they may be ren-

* Dewing, U. C. H., *Males*, vol. v. p. 19.

† *Clinique Méd.*, t. ii. obs. xv. xvi.; éd. ii. 1829.

dered obscure and uncertain by the primary disease. Hæmothorax of such origin may be abundant enough to drive the heart greatly out of its place. Thus, in a case of aneurism of the arch of the aorta adhering to the left lung, in which an effusion of about two quarts of blood into the pleura of that side produced sudden death, the heart was found lying to the right of the middle line.*

723. The absence of friction-sound will at the outset distinguish hæmothorax from pleuritic effusion. Hydrothorax is commonly characterised by affecting both pleural sacs almost simultaneously, and hence (no matter how great be the amount of percussion-dulness and fluid accumulation) by its not seriously displacing the heart sideways. The direct physical signs are the same in the two varieties of effusion: and the nature of the pre-existing internal disease will afford the main safeguard against error.

724. Rupture of the diaphragm with hernia of the spleen into the pleural sac above, is a combination that must very closely imitate grave internal injury to the side, with considerable hæmothorax. In point of fact, I do not see how the diagnosis could be made with surety,—and, in all probability, the infinite rarity of such form of phrenic hernia affords our only substantial protection against confounding two conditions so essentially different [572].

725. *Treatment.*—The treatment of hæmothorax only requires special consideration in its traumatic variety. Paracentesis is strongly recommended by surgeons of extensive military experience, at two conjunctures. First, at the outset of the hæmorrhage, if the quantity of blood effused be sufficient to threaten asphyxia by pressure on the mediastinum and opposite lung. But as the pressure of the extravasated blood against the bleeding vessels acts probably as a sort of mechanical obstacle to further hæmorrhage, a small quantity only of the fluid must be allowed to escape, the operation being repeated when urgent symptoms again set in. Such was Larrey's practice,—and it has been successful.† Secondly, at the end of ten or twelve days, if, in spite of venesection and antiphlogistic treatment generally, signs of pleuritis, followed by effusion, occur, the chest ought to be punctured. The results of thoracentesis are certainly more favourable in traumatic, than in idiopathic cases.

* Bell, U. C. H., *Médec.*, vol. vii. p. 169.

† M. Roux successfully removed three pounds of blood, extravasated in a case of fractured ribs; quoted by Sédillot, de l'Empyème, p. 167.

II.—PLEURISY.

726. Inflammation of the pleura, pleuritis or pleurisy, runs an acute or a chronic course,—in the latter case the disease may be chronic from the outset, or supervene on the acute malady.

727. *Anatomical characters.*—*Acute* pleurisy is, anatomically, signified by changes in the serous membrane itself, and in the sub-pleural connective tissue, and by the presence of abnormal materials in the cavity of the sac.

728. The membrane is vascular, —the injection being of the arborescent and capilliform varieties. True, the vascularity is principally in the subserous connective tissue, and only seen through the transparent serous covering; but tufts of capillary vessels also elevate the membrane from spot to spot, and shoot into its actual substance. The membrane loses its natural moisture and smoothness, its elasticity, transparence and consistence, sometimes even its natural thickness from separation of epithelium. Under special and rare circumstances it is locally destroyed by gangrene. The state of the nervous filaments (derived from the phrenic and sympathetic) is with great difficulty substantiated: in some cases they appear free from change; in others, it is affirmed, redness, and even thickening of the neurilemma may be detected.

729. The sub-pleural connective tissue is either simply injected, or also softened and cedematous,—in rare instances, actually infiltrated with pus.

730. The pleural sac contains solid, liquid, or gaseous new products. The *solid* material consists of exudation-matter, which vascularises rapidly, sometimes in thirty-six hours. There are inferential reasons for believing that good quantities of this matter may be completely absorbed; but as a rule it gradually undergoes conversion into induration-matter, or into pseudo-connective tissue, forming the material of persistent adhesions and agglutinations. The *fluid* contents, so-called serous effusion, consist of water holding in suspension exudation-corpuscles, pus-cells, epithelium, and frequently blood-discs, discoverable with the microscope; any one of these products may exist in sufficient quantity to be visible with the naked eye, while flakes of albumino-fibrinous matter and pus float or gravitate in all varieties of proportion. The quantity of albumen in solution varies from 31 to 77 per cent.; fibrine commonly exists in this dissolved state also,—the contents of the sac, perfectly fluid when first seen, subsequently gelatinising from fibrine-

coagulation.* The fluid may be solely purulent; but this is very rare in simple pleurisy. Unless from the accidental occurrence of sloughing, or special alteration of the fluids, *gas* does not form within the inflamed pleura.

731. *Localisation*.—In simple primary pleurisy one side only suffers, as a rule: bilateral pleurisy is, however, in some very rare instances, purely idiopathic; while in various diathetic affections, as tuberculous disease, Bright's disease, and scorbutus, both pleurae are very frequently attacked simultaneously. The surface of either sac may be generally, or only partially, inflamed: in the latter case, the pleurisy is called phrenic, pulmonary, costal, interlobar or mediastinal, according to its precise seat. In some instances corresponding, but limited, portions of the costal and pulmonary pleurae are affected, and thus arises the circumscribed variety of the disease. If adhesion of exudation-matter take place unevenly over such islets of inflamed surface so as to enclose spaces, the condition is called locular or saccular: two or more such circumscribed pleural collections may form, whence the terms bilocular and multilocular.

732. *Anatomical stages of the acute disease*.—The various appearances, now referred to, are found to occur, as a rule, in fixed sequence; hence have been established certain anatomical stages of pleurisy,—stages the more important, because they correspond with precision to striking changes in the physical signs, and even symptoms, of the disease. These stages are called the dry, the plastic, the effusive, and the absorptive.

733. (a) In the *dry stage*, vascularity and loss of natural humid polish of the pleural surfaces are the only morbid changes. (b) In the *plastic stage*, exudation-matter forms in adherent granules, patches or layers, or loose flocculent masses; sometimes on a sufficiently extensive scale to coat the entire lung. (c) In the *effusive stage*, serosity or purulent fluid, with the characters already described, accumulates, commencing at the base of the chest.† From the moment such accumulation sets in, the lung

* This I have seen take place in pleuritic fluid in from half an hour to an hour after its removal from the chest. Sometimes a second coagulation occurs much later, from twenty-four to thirty-six hours, from the presence of pseudo-fibrine, or "fibrine of retarded coagulation," as it has been called by Virchow. In a case of this kind Schlossberger suggests the retardation may have been due to some urea existing in the fluid. (Edinb. Journ., Oct. 1849.)

† M. Willems division of the effusive stage into two sub-stages, the *laminar* and *granulatus*, though founded so strictly on physical principles, that there is great difficulty in contesting its justness, may be ignored in a practical work, because clinically it cannot be subdivided; at least, I have never succeeded in finding the signs of a thin sheet of fluid equally spread over the entire lung, from apex to base. The

begins to suffer pressure,—pressure which may eventually condense the organ into a small elongated flattened mass, lying against the spine. The lung is then either partially or generally airless (even its persistent air [122] being forced from the cells), tough and leathery to the feel, of slaty gray hue on section, homogeneous-looking, and non-granular, and of such density as to sink instantly in water. The forcible contraction of a coating of plastic exudation sometimes aid the fluid pressure in thus emptying the lung absolutely of its air (*vide* CONDENSATION OF THE LUNG). (d) In the *absorptive stage*, the morbid products are more or less perfectly removed by absorption,—the lung at the same time gradually recovering its expansibility, or remaining more or less condensed. The latter condition will occur, when the pressure of the lung has been long maintained; and especially when the plastic exudation embracing the organ has passed into the condition of induration-matter;—the expansion-force of inspiration is unable to overcome the solid resistance offered by a lamella of the toughness, firmness, and slow molecular contractility possessed by that species of morbid product.

The stages, now passed in review, complete the evolution of the disease in its acute conditions.

734. *Anatomical stages of the Chronic Disease.*—(a) The exudation-matter of the acute disease non-absorbed, and possessing, as we have seen, either the characters of induration-matter or pseudo-areolar tissue, may form the substance of agglutinations and adhesions. By the former term, we designate that close union of the costal and pulmonary laminae which renders any collision of their surfaces in the movements of respiration impossible, and seriously impedes expansion of subjacent lung-tissue. Adhesions, on the other hand, are pseudo-areolar bands more or less long and loose, variable in thickness and firmness, sometimes distinctly meshed, vascularised or not, joining the visceral and costal pleurae, but interfering only in a slight degree with pulmonary play. Induration-matter may besides embrace a portion of lung, especially the apex, and tightly embracing it, absolutely prevent its expansion, and condense, and eventually cause atrophy of, its structure.

735. The meshes of adhesions may be infiltrated with serosity, or with pus. Or calcification, pseudo-calcification, or fat-formation,*

time during which the suction-force of the lung proves more powerful than the gravitation-force of the fluid must be exceedingly brief.

* Ellis, U. C. H., *Males*, vol. xi. p. 111.

may occur in their substance; or tubercle,* or melanic pigment,† be copiously deposited therein.

736. (b) Again, when the lung remains permanently more or less flattened and airless from the causes explained already [733], the thoracic walls undergo proportional retraction or depression, and the affected side ceases almost totally to take part in the process of respiration. Still, as inefficiency of one side may be made up for by extra-activity of the other, so long as the patient has no local suffering, and his general health maintains its past average, this condition cannot *per se* be clinically set down as a form of chronic pleurisy. On the other hand a pleural sac in this physical and anatomical state is exceedingly prone to fresh irritation,—the serous membrane itself, and even the vascularised exudation-matter, may inflame subacutely, or even suppurate from time to time, or tubercle be deposited within the diseased sac: under these circumstances there is indubitably one form of *chronic* pleurisy present.

737. (c) Farther, absorption occasionally fails to take place in the ordinary way in the acute disease; or secretion continues relatively so active, that the pleural sac remains persistently more or less distended with fluid (*empyema*). In this unfavourable state of things, more particularly observed in diathetic states,—such as those of phthisis, Bright's disease, and carcinoma,—the lung, reduced to its minimum bulk by pressure, eventually loses substance by a process of atrophy. The fluid is under such circumstances habitually purulent;‡ in protracted cases the ribs, sternum, or vertebrae become carious, or the ribs may become the seat of interstitial hypertrophy and sub-periosteal osteophytic growth;§ the costal pleura may undergo perforation, and sub-cutaneous abscess with fistula, eventually opening externally (*parietal fistula*), and daily discharging for months or years, a variable quantity of pus, may form. Sloughing of the pleural induration-matter under the latter conditions occurs from time to time; or this change may destroy the pyogenic membrane lining the strata of that induration-matter. Melanic pigment is sometimes found in the actual substance of the pyogenic membrane. Or perforation of the lung from the pleural side may take place,

* U. C. Museum, Models, No. 5060.

† Wick's, U. C. H., Moles, vol. 1 p. 61.

‡ In 162 cases of pleuritic effusion, collected from different sources by Krause (das Empyem, p. 36), the fluid was purulent in 101, yellowish serous in 41, and reddish serous in 20.

§ U. C. Museum, No. 4067.

and either close after the evacuation of the fluid in the sac through the air tubes, or permanently remain as a so-called *bronchial fistula*.

738. This brief outline of the anatomical conditions corresponding to the different clinical stages of the disease will render the course of the physical signs intelligible.

739. *Physical signs. Dry stage.*—The movements of expansion and of elevation, from the consensual avoidance of pain, are diminished on the affected side visibly, palpably, and by semicircular and antero-posterior measurement; their rhythm is slightly jerking. The percussion-sound is not perceptibly diminished in resonance; nor, on the other hand, have I found an increase of tone. The respiration is weak, but superficial, and jerking in rhythm. Grazing friction-sound may often be caught, especially about the infra-mammary and infra-axillary regions: in rare cases loud, rubbing friction-sound may be audible over the entire side, without a particle of exudation-matter having been thrown out.*

740. *Plastic Exudation stage.*—The state of chest-movement continues as before; rubbing vibration may sometimes be felt with the hand, but is rarely at this period perceptible to the patient: the vocal fremitus continues natural. The resonance under percussion is somewhat diminished; if it be at all notably impaired, and the sensation of resistance be even slightly increased, the plastic exudation is abundant; deep inspiration will restore the sound its natural characters. The respiration continues of weak, jerking type; and is accompanied with friction-sound of the rubbing or even grating varieties: pleural friction of cardiac rhythm [360] may also by possibility be detected. No influence is exercised on the resonance of the voice: if pseudo-ægophony exist, it depends on some condition extraneous to the pleura.

741. We may fail to discover friction-sound for any one of the following reasons:—1. Liquid effusion generally occurs with great rapidity; the time during which friction-signs are audible has therefore frequently passed by when patients apply for medical

* I base this statement on the following case—A man, dying of cardiac disease, presented on August 4, "all over the front and side of the left chest up to the first rib, grating and creaking friction-sound, accompanied with marked friction-fremitus; the patient is well conscious of this rubbing, but feels not the slightest pain." On this man's death, which occurred sixteen days later, fluid, which was known to have been meanwhile effused, appeared in the pleura; but the membrane was "entirely free from lymph, except over a spot about the size of half a crown at the angle of the seventh rib; this lymph is not rough, and does not look recent. The entire pleural surface is highly vascular, especially along the ribs and at their angles, the vascularity gives roughness to the surface."—J. Wilkinson, C. C. R., *Males*, vol. ix pp. 284, 306.

and,—2. Friction-signs may exist, but escape attention from their slight degree of development;—3. Or from auscultation not being practised immediately over their seat of production;—4. Or from too long a period being allowed to elapse between successive examinations of the chest;—5. In cases of absorption of pleuritic effusion, the development of redux-friction sound will be prevented, if the two pleural surfaces be uniformly agglutinated together; because locomotion of the lung is thus prevented;—6. In all cases of pleuro-pneumonia in which, while the infiltration and enlargement of the lung are sufficiently great to prevent its expansion, resolution of the pleurisy occurs before that of the pneumonia, pleuritic friction-sound (if we believe M. Fournet) cannot be developed. Dr. Stokes has also expressly noticed the rarity of friction-phenomena in pneumonia: “in no case has he found them after hepatisation had formed; and their co-existence with the crepitating râle in the early stages is extremely rare.” My observation is somewhat at variance with this statement: friction-sounds are occasionally audible directly over hepatised lung, if the consolidation be confined either to the centre or the periphery of the organ; besides, they are often well marked in front about the nipple, while the signs of hepatisation are perfect behind;—7. In some, *by no means all*, cases, friction-phenomena are audible in pleurisy after deep inspiration, when perfectly imperceptible during ordinary breathing. The natural inclination of pleuritic patients to restrain the movements of the chest as much as possible, may then prevent the development of rubbing sound.

742. *Effusive stage.*—(*Without dilatation of the side.*)—The jerking rhythm of the movements visible in the past stages now gradually disappears; and both the expansion and the elevation-classes of movement (the latter are less affected than the former) cease to be visible at the lower part of the side; the infra-mammary and infra-axillary regions become more or less bulged. The intercostal spaces, especially in the infra-lateral regions, may be less hollow, and sink in less with inspiration, than those of the healthy side. Vocal vibration, as a rule, is absolutely abolished, wherever fluid has accumulated to any amount; above the fluid, it continues perceptible; so, too, friction-fremitus, if it existed before, disappears wherever the fluid prevents the collision of the layers of exudation-matter; but may remain in full energy above the level of the effusion, or continue in front, while annulled in the back. Mensuration proves the existence of deficient expan-

sion and retraction ; but the difference of respiratory play on the affected and non-affected sides is not so great at this period of pleurisy as in more chronic conditions,—pain still interferes with the general chest-action, and the non-affected lung has not yet acquired the habit of expanding to its possible limits. Meanwhile loss of resonance with rise of pitch under percussion [Type I. 195] becomes very manifest, with increased parietal resistance, inferiorly ; the limits of the toneless and resonant parts are distinguished by a tolerably well-defined line,—and the area of the dullness, and its line of demarcation, may be changed by altering the patient's posture,* but not by the act of forced respiration. In rare instances the inferior lobe of the lung loses bulk so considerably by pressure, that a fall may occur in the upper limits of dullness, in consequence of the fluid gravitating downwards to fill the vacated space ; hence the area of superficial dullness may by possibility decrease, while the fluid actually increases. Tubular or amphoric percussion-note is habitually found at the upper front of the affected side [218—222], and sometimes posteriorly. Auscultation shows that the respiratory sounds are suppressed where the effusion is most abundant and weak, and distant from the ear where less abundant. Above the level of the effusion, they acquire exaggerated force, and more or less of harsh, bronchial, or even blowing quality. Friction-sound may still be sometimes discovered above the confines of the fluid ; and, when deficient in the back in the sitting posture, may yet be found there, if the patient be made to lie on the face for a while.† This is the most favourable period of the disease for the detection of ægophony, as already [416] fully explained : but the vocal resonance may be strongly or weakly bronchophonic, or may be absolutely null ; the cases in which ægophony is actually caught are certainly in the minority,—a fact for which an explanation has already been tendered. The heart's sounds are heard with greater intensity through a given thickness of fluid, and of lung solidified by condensation, than through an equal thickness of healthy parenchyma ; hence, in right pleuritic effusion, they are more clearly audible than in the natural state, in the right axillary region. Besides, the action of the heart may produce a sort of succussion or fluctuation-movement in the fluid, which, if that organ be

* This change in position of the fluid may be ascertained by percussion, even where the quantity is small, thus, where it reaches in the sitting posture only as high as the inferior angle of the scapula ; e.g. Humbert, U. C. H., Males, vol. ix. p. 14.

† J. Harrison, U. C. H., Females, vol. ix. p. 312.

hypertrophous, is very perceptible at the opposite surface of the chest.

743. *Effusive stage.*—(*With Dilatation of the Sule and Thoracic Inplacements.*)—The fluid having accumulated sufficiently to fill all available space in the pleural cavity, increased in capacity to a great amount by compression of the lung, begins to push the walls of the sac before it in all directions. The costal parietes, the mediastina, the diaphragm, and the apex of the parietal pleura above the clavicle yield before the encroaching liquid,—hence various important modifications in the physical signs.

(a.) The side, either expanded generally, or bulged below to a high degree,—motionless inferiorly, unless a powerful inspiratory effort be made, when a slow, dragging, upward movement takes place, posterior in time to the expansion of the other side,—sometimes exhibits a notable change in the state of its intercostal spaces; these may be widened, flattened, or even convex outwards, and in the latter state may exhibit, besides, visible fluctuation. On the other hand, considerable bulging of the walls may exist inferiorly in acute effusion, without any notable distension, or deficiency of inspiratory depression, of the interspaces; the latter may even be more obvious than on the healthy side: * may more, in chronic effusion with considerable general expansion of the side, a fair amount of normal intercostal breathing-action may be maintained † [66].

(b) The thoracic surface is felt to be unnaturally smooth; all vocal vibration has absolutely disappeared; and peripheric, more rarely simple, fluctuation may be detected by the fingers in the distended intercostal spaces.

(c) The semi-circular, antero-posterior, and vertical measurements of the side, and the distance between the nipple and middle line, increase; while the respiratory play falls notably,—in fact may be null.‡

(d) The dull percussion-sound of the previous period now extends upwards as far as, and even by possibility above, the clavicle, and passing the middle line in front, encroaches at the

* J. Harrison, U. C. H., Females, vol. ix. p. 312.

† Crochardet, U. C. H., Males, vol. ix.

‡ The respiratory play may be otherwise singularly perverted. Thus, in a case of left effusion (H. Morris, U. C. H., *Malta*, vol. vi. p. 33, January 1, 1821), the seventh and eighth ribs and interspaces below the left nipple sank in during forced inspiration, both visibly and palpably, while the abdomen rose considerably; yet semi-circular mensuration indicated at the same spot a respiratory play on the affected side of three-eighths of an inch (Insp. 17½; Exp. 16½ inches). This is a striking discordance between antero-posterior and general expansion movement.

upper part of the mediastinum on the opposite side of the chest. The displaced heart also carries its own proper dullness into the new position the fluid may have driven it. All sense of elasticity in the parietes has disappeared; and the outline of the dull sound is scarcely to be altered by changing the position of the patient.* Further, it is to be remembered that in the great majority, at least, of cases (prior to the period of uttermost possible repletion of the sac), the upper part of the chest, especially about the clavicle, first and second ribs, and adjoining part of the sternum, even to the other side of that bone, furnishes tubular or amphoric resonance [219]. I have observed the amphoric variety in cases of latent effusion, where the patient has been walking about, and unconscious of local ailment of any kind.

(c) The respiratory sounds, totally suppressed, except close to the spine and at the apex of the lung, possess in those regions a harsh, bronchial, or even slightly blowing quality—a quality explicable by the condensed state of the tissue. In many cases, however, diffused blowing respiration is pretty extensively heard over the diseased side.† Friction-sound, in rare instances, still continues audible in some limited spot: the rule is, that it totally disappears. The continuance either of ægophony or any other form of vocal resonance is unusual; but strong bronchophony about the inferior angle of the scapula may coexist with abundant effusion, and annulled vocal fremitus.‡ The heart's sounds may be heard through the fluid, either imperfectly.§ well,|| or with even extra-fullness,—the reason of these differences not being always apparent.

(f) The diaphragm, depressed to a variable amount, carries with it the liver or spleen; along with the mediastinum, the heart is pushed to the opposite side. The amount of lateral detrusion of the heart is sometimes very remarkable: in cases of left effusion, the organ may pulsate outside the right nipple; and thirty-six hours will sometimes suffice to produce this amount of mal-posi-

* Even at this advanced period of effusion, alteration of the kind is, however, possible. If a patient with fluid enough in the pleura, when he lies on the back, to render the sound toneless to the opposite side of the middle lobe, be made to lie on the side of the effusion, in the course of a minute or two the sound acquires tone at the mediastinum. I have found this point of considerable utility in certain cases in determining whether there was or was not mediastinal tumor present, in addition to abundant pleural effusion; it cannot, however, be implicitly trusted to, as a tumor may grow into one side slightly to the other.

† T. Harrison, U. C. H., Females, vol. ix.

‡ Crowhurst, U. C. H., Males, vol. ix, p. 142.

§ Bernard, U. C. H., Males, vol. xii, p. 235.

|| Ward, U. C. H., Females, vol. xi, p. 63.

tion. The visible and palpable impulse of the organ, and the maximum points of its sounds, especially of the first, prove its change of place. Does the displacement exercise any influence on the characters of the sounds? Most unquestionably it does not, in the great majority of cases; my experience on the point perfectly accords with that of Dr. Stokes, who feels convinced that, even when at its height, the displacement "does not cause any alteration in the natural sounds of the organ." But the rule, I am equally persuaded, is not without its exceptions. Dr. Hope describes the following peculiarity in a case of right lateral detrusion from effusion in the left pleura: "The aorta was felt to pulsate between the second and third right ribs, an inch from the sternum; and here a murmur was heard with the first sound, which has ceased since the heart has been restored to its natural situation by the absorption of the fluid. Is it, therefore, possible that a twist given to the aorta, or pressure of the vessel against the ribs, may be the cause of a murmur under such circumstances?" I once found, for many successive days during the height of left pleural effusion, both sounds of the heart, which was pushed to the right of the sternum, more or less masked by blowing murmurs; these murmurs, when the heart was restored, or very nearly restored, to its natural position, almost completely disappeared,—a fact the more remarkable, as, from the slowness of convalescence, plenty of time had elapsed for the formation of the systolic basic murmur of *spanæmia*. The diastolic murmur disappeared the more perfectly of the two, and must positively have depended, probably through torsion of the aorta, on the malposition of the organ.* Larrey has related a case in which extreme feebleness of the pulse in the large arteries co-existed with cardiac displacement; there can be no certainty, however, that there was any mutual dependence between the two circumstances.

(*q*) No matter how copious the effusion, whether acute or chronic, nor how complete the evidences of centrifugal or dilating pressure, signs of centripetal pressure [485] are, as a rule, absolutely wanting,—the trachea, œsophagus and large veins escape serious encroachment. Hence the detection of the latter class of signs, in a case of pleuritic effusion, may be accepted as proof of some additional disease, such as tumor or aneurism, within the chest. I have, however, seen a single vein, such as the epigastric, external jugular, or mammary, enlarged in calibre in cases of pure effusion.

The laws of hydrostatic uniform pressure seem to me readily to

* H. Morris, F. C. H., *Males*, vol. vi pp. 35, 38.

explain the well-nigh invariable exemption of special internal parts from interference.

744. *Stage of Absorption.*—The absorption of pleuritic effusion is effected with results of two different kinds on the form and condition of the chest. The walls may be simply restored to their natural position, or they may sink inwards,—inside, as it were, their natural site. Hence, clinically, we have a period of absorption *without* and *with retraction of the side*: of these the former is infinitely the more favourable.

745. *Absorption without retraction.*—The visible enlargement and bulging gradually disappear, and with them, but very slowly, the obstructed state of the chest-motions: the natural intercostal hollows, deepened, as a rule, by emaciation, are again felt; friction-fremitus* and vocal vibration return,—the former often with greater intensity than at the outset of the disease. The various measurements fall to their natural standards. The percussion-sound gradually recovers its natural resonance, first at the upper, then at the lower, regions; in the latter, indeed, it may long,—for weeks, or even months,—remain more or less toneless in consequence of imperfect expansion of the still collapsed lung, and accumulation of exudation-matter in the pleural sac. The tubular note under the clavicle disappears much earlier,—normal resonance returning long before healthy tone reappears at the base: still I have known it continue for two or three weeks after the patient was practically convalescent. The respiration sounds, gradually restored, remain for a variable time weak and harsh or bronchial; friction-sound, mixed or not with pleural pseudo-rhonchus [355] or pulmonary pseudo-crepitation [365], reappears for a variable period; regophony is sometimes caught passingly for a day or so, but the vocal resonance quickly becomes bronchophonic, or may be null. The heart, with the mediastinum, returns to its natural position, sometimes with singular celerity. I once saw a heart beat in its exact normal site, which, seventy hours only before, I had felt pulsating under the right nipple; absorption so rapid, singularly rare under all circumstances, was here the more remarkable, as the patient was tuberculous, and had had several attacks of profuse hæmoptysis.

746. *Exceptional Signs.*—At this period of the disease very singular signs may temporarily occur. Thus, in a middle aged

* Redux friction-fremitus may remain for a long time perceptible to the patient himself. John Smith (U. C. H., Males, vol. x. p. 68) first perceived it January 13th, and felt it distinctly, on full inspiration, when discharged at the close of March.

enfeebled male, undergoing absorption of moderate effusion, with probable acute lung-consolidation conjoined, the following facts were noted. "Tubular percussion-sound in the left infra-axillary region; at the inferior angle of the left scapula the voice is strongly resonant, with a whispered echo after each word, exactly as if the voice were reproduced in whisper under the stethoscope; at this spot obscure friction-sound, with thin various-sized rhonchal sounds; the respiration here is hollow, of cavernous quality, especially in expiration. Even with whispered voice the pectoriloquous echo is perfect; though the laryngeal whisper is so low as to be scarcely audible by the ear held close to the patient's mouth." Eleven days later the percussion-sound had become pulmonary in the main at the inferior angle of the scapula; little was heard there in calm breathing; under effort, feeble respiration, mixed with friction-sound and loose rhonchus, became audible; the vocal resonance had lost all the peculiar characters above described, being simply exaggerated, and not hollow in quality. This patient had perished of Bright's disease (for which he had been originally admitted) on the 29th of December,—that is about five weeks after the percussion-sound had become pulmonary, in the main, about the inferior angle of the left scapula,—when dissection disclosed the following condition of things. "The lower lobe of the left lung so closely adherent in the corner of the pleural sac, that the upper lobe is nearly torn away, in the attempt to remove the whole organ; bronchi large, dilated even in some parts: tissue, especially of the posterior part of the organ, firm, instantly sinks in water without pressure; no tubercle or gray granulation."* Now in this case increased conducting power on the part of the solidified lung substance, combined with dilatation of the bronchi, seems to explain the ringing hollow quality of the respiratory and rhonchal sounds. The vocal whisper within the chest could not have depended on unison-resonance, seeing that it did not synchronise with, but followed, the first resonance; nor upon consonance, for it occurred with various words spoken with not precisely the same pitch: it manifestly depended on echo of the first resonance, which it followed at a certain interval of time.

747. I have, since this observation, met with several more or less perfect examples of the same peculiar phenomena,—sometimes in cases of complete recovery from idiopathic pleurisy.†

* Forbair, U. C. H., *Males*, vol. ix. pp. 350–352; vol. x. p. 132.

† F. Smith, U. C. H., *Males*, vol. xi. p. 135. Hall, U. C. H., *Males*, vol. xiv. p. 3. This patient, a boy, had also echo-phenomena at the healthy, arising from the peculiar state of the diseased, side of the chest [413].

748. *Absorption with Retraction.*—General retraction of the affected side is very much less common than partial depression,—the latter occurring probably about twelve or fifteen times as frequently as the former: general retraction is a process requiring much time for its accomplishment. From the inquiries of M. Woillez, partial depression would appear to be more frequent in front on the right side, behind on the left side. The shoulder, the ribs, and the nipple, fall, though in some very exceptional cases the shoulder rises; the scapula becomes tilted outwards at its inferior angle; the dorsal spine curves laterally, the convexity looking, at least in the majority of cases, towards the sound side; and the ribs undergo distortion, their external planes becoming more or less inferior. This altered condition of the ribs lessens the width of the intercostal spaces; and in cases of very chronic course hypertrophous and osteophytic enlargement of the bones still farther decreases that width. The chest-surface laterally is unnaturally irregular and uneven; in front it may be flat, smooth, and even slightly concave, the distinction between the ribs and interspaces being completely lost to the eye. Rubbing vibration is rarely to be felt. All the chest measurements (those of the side, generally, as well as the partial class) undergo diminution, with the exception of that between the clavicle and nipple, which increases.* The measured chest-play, on the diseased side, may be absolutely, or next to absolutely, null, while that of the other side exceeds the individual standard of health. The percussion-sound, dull, with marked resistance, inferiorly, acquires the wooden quality at the mid-height of the thorax, and is often tubular at the apex, in front and behind. If dilatation of the bronchi supervene, the tubular note may be very extensively discernible. The enlargement of the ribs, just referred to, contributes to give an osteal character to the sound, especially laterally. The signs obtained by auscultation, though less striking than these, are sufficiently important: the respiratory sounds, more or less completely suppressed at the extreme base, are superiorly weak, bronchial, or diffused blowing,—months may elapse, after retraction has commenced, before respiration is restored to any extent at the base; friction-sound, of creaking or grating type, may or may not be audible; the voice resounds with morbid intensity, especially at the central parts of the side.

749. The vault of the diaphragm and subjacent viscera are

* This comes of lowering of the nipple—more valuable as a morbid sign on the right than the left side [31]

sometimes drawn above their natural level, an elevation not faithfully indicated by changed position of Harrison's sulcus [529].

750. The site of the heart varies in five different ways:—(a.) The organ having slowly or rapidly, gradually or suddenly, retraced its steps, recovers either its natural situation, or the immediate vicinity of this: here is the most common case. (b.) It remains in the abnormal position into which it was forced by the effusion, in consequence of the establishment of adhesions. (c.) The tractive force may be so powerful at the period of absorption as to *pull* the organ out of its place in the converse direction to that into which it had previously been *pushed*: an occurrence best observable when the right pleural sac has been affected.* (d.) It may happen, according to an observation made by Dr. Stokes, that the heart hangs more loosely than natural in the chest, and so falls somewhat to the right or left, as the patient lies on this or that side. (e.) Or it may happen, in cases of left effusion, that the heart, originally pushed enormously to the right, subsequently passes to the left, even beyond its natural site,—and still later, regains more precisely its normal position by repassing a very little to the right.†

751. The physical signs, now described, are those of the disease from the moment of attack to its final term,—in other words, of its acute and chronic forms. I may here mention two signs of exceeding rarity, one example of each of which has fallen under my notice. *Perfect cracked-jar note* in the first and second inter-spaces during the height of effusion and subsequently;‡ and loud rubbing *redux* friction-sound, with four or five jerks in inspiration and expiration *above the clavicle*.§

752. It seems, further, expedient to add a few words concerning the state of the signs at the apex in the chronic disease, where retraction and its concomitant changes exist below.

Now these signs may be significant of: (1) A fairly natural condition of texture, the respiration-sounds being free, but a little harsh and raised in pitch; there may also be a slight rise in the pitch of the percussion-note; and, if the chest-wall happens to be flexible and hence easily depressible, cracked-jar sound (as in the case just referred to) may be produced by the abrupt expression of air from the lung-tissue. (2) There may be distinct signs of a more solid state than natural,—and this may depend

* Griffiths, U. C. H., *Males*, vol. ii. p. 174.

† Lockett, U. C. H., *Chin. Lect.*, 1st ed.; loc. cit. p. 299, 1849.

‡ Underley, U. C. H., *Females*, vol. vi. p. 85.

§ Wiles, U. C. H., *Males*, vol. vi. p. 122.

on contraction and condensation of the apex by surrounding induration-matter, or on chronic pneumonia, or on the deposition of tubercle.

Symptoms of Acute Pleurisy.

753. *A. Local Symptoms.*—Acute idiopathic pleurisy may or may not commence with rigors; they are rarely strongly marked, and I have never known them of the severity frequent in pneumonia. Rigors, or mere chilliness, followed by heat, generally moderate in amount, and certainly not acrid or burning, may be either actually the first symptom, and anticipate local suffering by some hours or even days, or be preceded for a few hours by the characteristic pain or “stitch in the side.”

754. This peculiar pain, dragging, and shooting in character, increased by movement, deep inspiration, direct pressure, and percussion, varying in severity from a mere annoyance to a feeling of agony, commonly seated below the nipple, near the antero-lateral attachments of the diaphragm, and under the scapula, rarely extending over the entire half of the chest, sometimes referred solely to the non-inflamed side,* still more rarely limited to the confines of the abdomen, or the abdomen, and this when no physical evidence of local peritonitis exists, felt generally in inspiration more than in expiration, in rare instances solely with the latter act,† is persistent, temporary or intermittent, and sometimes totally disappears, more commonly remits, with the occurrence of effusion.

755. The immediate cause of pleuritic pain is far from clear. Both costal and pulmonary pleurae may be vascular in the highest degree, the surfaces free from exudation, friction-sound intense, and yet not the least pain or tenderness exist.‡ There may even be strong friction-fremitus from exudation-matter, without a particle of local suffering.§ On the other hand, intense pain may coexist with friction-sound, limited to a surface no larger than the palm of the hand.|| Again, there may be intense abiding pain, with sharp stitch on full inspiration, without friction-sound.¶ Lastly, there may be friction-sound in inspiration and expiration, pain in inspiration only.**

* Lockett, U. C. H., loc. cit. Probably from coincident pleurodynia.

† Bassett, U. C. H., Females, vol. vii. p. 229.

‡ Wilkinson, U. C. H., Males, vol. ix. p. 284.

§ Humbert, U. C. H., Males, vol. ix. p. 14.

|| Young, U. C. H., Males, vol. ix. p. 294.

¶ Styles, U. C. H., Males, vol. x. p. 304.

** Casey, U. C. H., Males, vol. xii. p. 49.

Obviously, then, friction of inflamed surfaces is not the cause of the pain in question. Besides, pleurisy, even purulent, is sometimes latent; so that, instead of regarding stitch in the side, with Cullen, as the essence of pleurisy, we are forced to regard it as an epiphenomenon. Chest-movement fails, sometimes, to produce it; and patients' descriptions of its qualities widely differ. I cannot help thinking its mechanism likewise differs,—that it may depend either on inflammation of the pleural nervous filaments themselves [728], on intercostal neuralgia or neuritis, on actual inflammation of the diaphragm, or the intercostal planes themselves, or on mere pleurodynia: the two latter modes of causation would be distinguished by the marked increase of suffering from movement.

756. Tenderness under pressure—traceable sometimes apparently to the subcutaneous muscles, sometimes to the pleura itself, sometimes to the intercostal muscles, or lastly to the intercostal nerves—generally exists.

757. In addition to the local suffering reflex pains may be felt in the iliac fossa, or even at the upper part of the thigh.

758. Increased frequency of breathing is a very constant symptom, perhaps more so even than local pain: it may be unnoticed by the patient, or attended with distressing sense of dyspnoea. The number of respirations very rarely exceeds the third of the number of the heart's pulsations: indeed, I do not remember ever to have observed, in a positively uncomplicated case in the male, a pulse-respiration ratio lower than 2·7:1.* An enormous amount of effusion may coexist with a ratio of 3·5:1. The ratio is more perverted in the sitting than in the lying posture: thus, in a case of copious effusion:—

	P.	R.	Ratio.
Lying	122	36	3·39:1
Sitting	123	44	2·83:1

It is important, however, to distinguish genuine dyspnoea from the mere spontaneous hastening of shallow breathing, which sometimes comes of the petulance of pain. The breathing-movements, as we have seen, are restrained in amount on the affected side; their increased frequency acts as a sort of compensation.†

* In nervous and hysterical females the ratio may, however, fall lower than this under the influence of painless pleuritic effusion. The temperature of the expired air may fall sensibly below the average of health under these circumstances. Harrison, U. C. H., Females, vol. ix. p. 309.

† This restraint of motion on the pleuritic side is a remarkable instance of compensational action, or of motion regulated involuntarily by sensation. It cannot be initiated by the will, and is therefore involuntary; it depends on sensation, and is therefore not reflex, at least in the Marshall Hall sense of the term.

The dyspnoea is generally more marked at the outset, than after effusion has occurred.

759. Cough exists in the great majority of cases, dry (unless there be coexistent bronchitis), short, small, stifled as it were, and frequent; it may, however, be completely absent, though the febrile state be highly marked.

760. During the dry and plastic stages, the patient commonly lies on the sound side or on the back; I have seen exceptional individuals lie by choice on the diseased side, to control movement, and stifle pain, as they assured me: generally speaking, this posture increases pain. After effusion has occurred, the patient commonly lies on the back, on the affected side, or diagonally between both, with the head somewhat raised: he may, however, day after day, while copious effusion exists, lie on the sound side.*

761. *B. General Symptoms.*—The general symptoms are those of a sub-febrile inflammation. The pulse is frequent, sometimes hard and concentrated; the skin, hot, but not acridly or burningly so, at the outset, becomes moist at the effusion-period. There is but slight prostration of strength; and the cerebral functions are very rarely affected. The urine, small in quantity, is of high specific gravity, deep colour, and strong odour, may be temporarily albuminous, as in other acute affections, has been found in rare instances impregnated with fibrine, and contains oxalates often at the period of convalescence; but in all this there is nothing distinctive. The blood is hyperinotic,—the fibrine varying from 3.5 to 7 per 1000: as a rule, it ranges lower than in pneumonia. The buffy coat is absent from blood drawn in about one-fourth of cases. The thermometer indicates sub-pyrexial heat,—often scarcely reaching 100°.

762. *Coexistences.*—Acute pleurisy is often followed by limited plastic pericarditis, or peritonitis, the latter most common on the right side. Pneumonia is an excessively rare sequence, on the affected side especially; indeed, the effect of fluid pressure is to disgorge the lung of its blood in great measure, as well as of its air. The association of pneumonia and pleurisy proceeding *pari passu*, and each modifying the progress of the other, is not common. Again, a slight amount of plastic exudation in the pleura is so common in pneumonia, that pleuro-pneumonia and pneumonia may, in that sense, be used as convertible terms; but pleurisy of clinical importance, and producing effusion, does not

* Harrison, U. C. H., Females, loc. cit.

occur in more than about one-eighth of cases of pneumonia. Bronchitis does not often co-arise with acute pleurisy, and is not an obvious effect of it either.

763. *Terminations.*—The terminations of acute pleurisy are by recovery, effected either by resolution or absorption; by lapse into the chronic state; and, under certain circumstances, by death. Death (whether produced by asphyxia, by syncope, or by exhausting asthenia) is so rare a result of the disease, when attacking individuals free from organic affections, that I have to my knowledge, since my attention was first drawn to the matter, years ago, by M. Louis, lost but two patients from pure primary idiopathic *unilateral* pleurisy, with or without effusion.* And, although, where chronic disease either of the lungs or of other organs pre-existed, death is a more common result, it is still an unusual one. Pleurisy is rarely the immediate cause of the fatal event in phthisis; it is only so by rare accident in chronic bronchitis; and, although both pleuræ suffer in blood-diseases attacking the serous membranes, as for instance, in uræmia and pyohæmia, pleuritis is even here not only an uncommon apparent cause of death, but, when apparently destructive to life, is generally conjoined with pneumonia. I have, proportionately to the rarity of these diseases, found the secondary pleurisy of carcinoma of the thorax and its contents † the most fatal variety.

SYMPTOMS OF CHRONIC PLEURISY.

764. Chronic pleurisy presents itself clinically in three conditions or forms:—(1) With retraction of the side, and the various accompanying physical imperfections already described: (2) With permanent dilatation of the side by sero-albuminous or purulent fluid (*empyema*): (3) With permanent fistulous opening in the pleura, and discharge of pus from the sac.

765. (1.) In the first case of retracted side, the rule is, the general health ranges below par,—the individual is thin, incapable of much physical or mental effort, and prone to slight passing attacks of inflammation in the affected side. The breath is rather short, and dyspnoea easily evoked; there is frequent pain in the side. But in exceptional instances, hypertrophy of the fellow lung occurs on a more or less extensive scale, and the patient does not, *quoad*

* In this case (Ward, U. C. H., Females, vol. xi. p. 62), remarkable in many ways, perforation of the lung occurred through the diseased pleura on the fifty-first day, and out the patient off suddenly, at a time she appeared to be doing favourably. Aged thirty-three; she was wholly free from organic disease, even in the lungs themselves.

† Dewing, U. C. H., Males, vol. v. p. 19, Unwin, U. C. H., Males, vol. iii. p. 239.

facility of breathing (breathing power is another thing), differ notably from healthy persons: subjectively he may be perfectly free from dyspnoea.

Rare instances occur, in which the patient maintains vigour, and grows fatter than he had ever been prior to his attack.

In cases of extreme retraction there is sometimes a tendency to recurring dry inflammation of the other pleura; this is a most perilous state of things: for if effusion occur, asphyxia might ensue before relief could be obtained. I have, however, known friction-sound continue for three months, on the relatively free side, under these circumstances, without any grave result ensuing.

766. (2.) *Empyema*.—*Symptoms*.—In the second case, of persistent distension with sero-flocculent or purulent fluid, symptoms of more prominent character exist. The patient either lies on the back, or diagonally on the diseased side, with the head slightly raised and bent towards that side, but often acquires the power of lying on the healthy side under the influence of treatment. He rarely suffers from local pain, unless some intercurrent acute inflammatory action arise. His dyspnoea varies in amount; I have never known it seriously pervert the ratio of the pulse to the respiration. The voice is weak; the cough frequent, either dry or attended with expectoration, muco-purulent or purulent. Not only does empyema not give rise in itself to hæmoptysis, but, if established in a case of phthisis, it appears to a certain extent prophylactic against the hæmoptysis, which is almost an appanage of the latter disease.*

767. The source of expectoration is various. (1.) Steady and rather abundant expectoration may occur from some co-existing affection of the lungs or bronchi. (2.) Sudden profuse pouring forth of sero-pus by the bronchi takes place through perforation of the pulmonary pleura. (3.) It occasionally happens that the expectoration, without changing in quantity, acquires the precise odour which, on post-mortem examination at a later period, is

* "In sixteen well-marked cases of empyema which I have had under my care within the last two years, for periods of three months and upwards, no single example of hæmoptysis occurred. But, more than this, empyema established in a phthisical person, seems to be preventive of hæmoptysis. In seven cases of combined tuberculous excavation and empyema, carefully watched and proved as to the diagnosis, either by dissection or by indubitable signs, no spitting of blood had ever occurred. All these seven persons were males. The pressure exercised on the lung by the contents of the pleura might appear to explain the fact plausibly enough, especially as the excavations were on the same side as the empyema in six of the seven cases, and I have recently seen a curious exemplification of the apparent influence of excessively acute pleuritic effusion in arresting *habitual hæmoptysis*. But, on the other hand, in one case, excavations existed in both lungs."—Author's Report on Phthisis, as observed at the Hospital for Consumption, Br and For. Med. Chir. Rev., Jan. 1849.

detected in the contents of the pleura: does exosmosis through the serous membrane take place? I have observed this where perforation followed somewhat later.* (4.) Occasionally a sudden gush, to the amount of a pint or upwards, of sero-pus takes place, without our being able to detect any evidence of pneumo-thorax. Now two interpretations present themselves: either the fluid has made its exit through a perforation without allowing the entry of air into the sac; or a metastatic flux has occurred from the tubes. Both views have their difficulties.

768. Oedema of the affected side of the chest is common; it may extend to the corresponding limbs, and half of the abdomen, leaving the other side of the body almost, or completely, unaffected. Clubbing of the finger-ends on the diseased side is sometimes strikingly marked. The face grows puffy, and semi-transparent, without malar flush; the lips tumid and livid. The external thoracic veins are not enlarged, the eyes are not prominent, there is no dysphagia, and no stridulous character in the voice or cough: in a word, there are no signs of centripetal pressure [485]. The opposite lung becomes hypertrophous and emphysematous; sometimes its bronchi, more rarely its parenchyma, inflame [775].

769. The pulse is habitually frequent, quick and small; the patient easily falls into a state of syncope; the skin is hottish and dry, the pyrexia of hectic type, whether the contents of the pleura be pure pus or not; the temperature rises but little; anorexia and insomnia combine with other causes to produce emaciation.

770. Empyema is greatly more common in males than in females. Of twenty-two cases, of which I have records, three only refer to females; Heyfelder † found but one female among twenty empyematous patients; Krause (loc. cit. p. 109) has collected from various authors one hundred and thirty-seven cases, of which ninety-six were in males, eighteen in women, and twenty-three in children. Acute pleurisy is also more common among males, but not by any means to the extent here disclosed in respect of empyema; it would follow then that pleurisy has a greater tendency to degenerate into empyema in males than females,—a result the less to have been anticipated because tuberculisation is more common in the latter sex.‡

771. The proportion of cases of acute pleurisy lapsing into the

* Ward, U. C. H., *Females*, vol. xi. p. 62.

† *Arch. de Médecine, Série Série*, t. v. p. 59. 1839.

‡ Cruveilhier asserts that puerperal pleurisy is scarcely less common, at the Maternité, than puerperal peritonitis. (*Bull. de l'Acad. de Méd.*, t. v. p. 104. 1836.)

chronic state is unestablished: it is, on the whole, unquestionably small.

772. *Terminations*.—The terminations of empyema are: (1) by death, through slow asthenia; (2) by recovery, through absorption, or through evacuation of the fluid by the bronchi or parietes,—the opening undergoing closure after it has served its purpose; or (3) by lapse into the fistulous form of the chronic disease.

773. (3.) *Permanent Fistula*.—There may be one or more fistulae, and the discharge may be trifling in amount, or sufficiently abundant to account in itself for emaciation. In these cases, retraction of the affected side is carried to the extremest amount possible: the measurement between the nipple and the middle line may, as I have seen, fall to one inch and a quarter less on the diseased than the healthy side; while hypertrophy of the opposite lung* reaches its maximum. The symptoms in this variety of the disease are habitually similar to those of the form last described. In rare instances, not only is life prolonged without obvious suffering, but the individual is able, with care, to follow his ordinary pursuits: I had two cases of the kind under observation for years,—in one of these half-a-pint of pus was occasionally discharged in a day. Death in the great mass of instances is the slow result.

774. In the majority of persons the fistulous opening is parietal, sometimes pulmonary, sometimes pulmonary and parietal combined. In rare instances communications form with distant parts by straight or tortuous sinuses, as with the intestine (feces† or lumbrici‡ entering the thorax) or with a lumbar abscess opening in the groin.§ Pus-collections in remote sites sometimes work their way to the pleural sac,—as, for example, a pyælitic accumulation;¶ or disease of a distant organ, as the stomach, may lead to perforative communication through the diaphragm with the pleura, and produce secondary empyema.¶

775. *Alliances*.—The main relations of empyema to other

* The lung in this state, instead of receding, when the chest is opened after death, may actually protrude through the opening. I have known the difference in the semi-circular measurements of the sides, equal four inches in a case of the kind. Increase of bulk of the sound lung takes place, with tolerable speed, too, thus (T. Weeks, U. C. H., *Mobs*, vol. i. p. 59, 1847) by measurements made at an interval of eight months, an increase (atrophy having all the while advanced) amounting very nearly two inches in the semi-circumference of the side, was substantiated.

† Kruse, *Das Empyem*, p. 82.

‡ Loschke, in *Brit. and For. Med. Chir. Rev.*, vol. xiv. p. 527.

§ Kruse, p. 80.

¶ Beyer, *Mal. des Reins*, t. iii.

¶ U. C. Museum, Carswell's Drawings.

diseases seem to be these. Various diathetic states, the tuberculous, the syphilitic, the purpuric, the cancerous, and that of Bright's disease, appear often to act as its causes, both by leading to, and by preventing direct recovery from, the original acute attack. On the other hand, empyema, especially on the right side, tends to produce disease of the liver, and ascites.* A few instances have fallen under my notice where Bright's disease was certainly, as far as the evidence of symptoms went, secondary to empyema,—but whether as an effect or a coincidence seems doubtful.† Bright's disease is often, where it exists, the immediate cause of death.

I have not yet met with any positive evidence that the lung on the unaffected side is peculiarly prone to pneumonia of an uncontrollable character, as asserted by some writers. Hypertrophy of its substance and inflammation of its tubes, are the only conditions I have observed to be unduly frequent.

Diagnosis of Acute and Chronic Pleurisy.

776. The diagnosis of pleurisy is in the majority of cases sufficiently simple; but at all its periods there is a certain risk of confounding it with other diseases.

777. In the dry period, *pleurodynia*, an impending attack of *zona*, *thoracic myalgia*, *intercostal neuralgia* and *costal periostitis* with *bronchitis* accidentally co-existing, are the affections most easily mistaken for pleuritic seizure. The rules for distinguishing them have already been given [506, 508, 514, 522, 527].

778. In the plastic stage, pleurisy may, under ordinary circumstances, be distinguished from *plastic pericarditis* by the respiratory rhythm of its friction-sounds. In those comparatively rare cases, where the heart's action produces friction of its own rhythm within the inflamed pleura, while the pericardium is perfectly free from disease, the following conditions will argue in favour of the sounds being really produced in the pleura: the limitation of the sound to either edge, generally the left, of the cardiac region; fixity in one or more particular spots; complete cessation of the sound (or, what is more common, cessation with certain beats of the heart) when the breath is held; and marked unsteadiness in the intensity and quality of the friction-sound. The course of events will soon settle the question, should doubt remain in spite

* Wals, F. C. H., Males, vol. 4, p. 59; Griffiths, U. C. H., Males, vol. ii, p. 174.

† Griffiths, U. C. H., loc. cit.

of the aid of those rules; if the friction of cardiac rhythm be pericardial, the signs of pericardial effusion will, with almost absolute certainty, quickly follow.

779. *Friction in the peritonæum* is, especially at the upper part of the abdomen, with difficulty distinguished, as its rhythm is respiratory, from similar sounds in the lower part of the pleura. Indeed, I know of no positively distinctive character, except the locality of the sound; if this be obviously beyond the confines of the chest, and if there be no such friction in the pleura as to account for rubbing sound being heard under the abdominal walls, as an effect of mere conduction, its origin in the peritonæum must be admitted; * both kinds of sound may or may not be accompanied with friction-fremitus.

780. Pleuritic effusion, when acute, may be confounded with *pneumonic solidification*. But (*a*) in the former the interspaces are either bulged outwards, or *move more freely* with the respiration-act, than in consolidation of similar superficial extent. (*b*) In effusion, vocal fremitus disappears; in hepatisation, it is maintained at, or raised above, the average of health.† (*c*) In some rare cases peripheric fluctuation, discoverable by flipping in an interspace or striking a rib [83], will settle the difficulty in favour of fluid. (*d*) The percussion-sound under the clavicle on the affected side in effusion is tubular or amphoric, unless the whole pleural sac be filled with fluid; such quality of percussion is very rare in hepatisation, and exists over the most, not the least solidified, parts. The transition from toneless to natural percussion-sound is more abrupt and better defined at the edge of effused fluid than of inflamed parenchyma. Occasionally, too, the exact limitation of dulness to the area of a lobe may be traced by percussion on the surface. Now, such limitation is more likely to depend on hepatisation than on fluid in the pleura; still the line of effusion does sometimes coincide with singular precision with that of the upper edge of the inferior lobe. (*e*) In effusion, there is no

* T. Barker, U. C. H., Males, vol. iv. p. 55; Harrison, U. C. H., Females, vol. ix.

† This guide is of comparatively little service, when the left side is affected, the vocal fremitus is naturally so weak on that side. Luckily for purposes of diagnosis, mal-position of the heart is most readily affected by effusion into the left pleura. The fremitus-sign is almost valueless in persons with very feeble voices, whether naturally so or from disease. Besides, in cases of *very extensive* and *very dense* hepatisation, the fremitus may be impaired in strength, though not to the same extent as with an equal amount of dulness from effusion: vocal fremitus may be caught *along the spine* in some cases of abundant effusion,—and unfortunately in some instances at some distance outwards from the vertebrae. I have often known fremitus tubular and vocal resonance strong over effusion, but have not, to my recollection, met this contradictory combination in hepatisation.

true crepitant rhonchus; nor have I ever found true tubular, sniffling, metallic respiration: such blowing respiration, as frequently occurs in pleuritic effusion, is of the diffused variety, *deep-seated*, except close to the spine,—and slight in amount as compared with the amount of percussion-dulness present. Vocal resonance is either null, ægophonic, or strongly, or weakly, bronchophonic; in hepatisation, it is high-pitched, metallic, coarse, strongly and snifflingly bronchophonic. Those rare cases of pneumonia, where vocal resonance and respiration-sound are completely deficient, will be considered hereafter. (f) If by placing the patient in the prone position, we find the percussion-dulness at the back decrease, the respiration increase, in amount,—and if friction-sound, before inaudible, reach the ear, the case is positively one of effusion: but if these physical signs remain in *statu quo* after such change of position, the case is not necessarily one of hepatisation. In effusion, the heart is displaced, and dulness extends across the mediastinum. It is true, the same extension of dulness beyond the middle line occurs to a very slight amount in some cases of pneumonia; but where this is the fact in hepatisation, change of position does not affect the mediastinal dulness; whereas it does affect this, as already explained, in cases of effusion. (g) The absence or presence of rusty sputa, of acrid heat of skin, and, above all, the state of the pulse-respiration ratio may be appealed to for further aid; an amount of pneumonic solidification, so great as supposed, will produce a ratio of 2 : 1 or 1·5 : 1. I have never known such perversion result from mere effusion, and the ratio *may*, with copious accumulation, fall within the natural limits. The amount of diagnostic trust to be placed in the condition of the chlorides in the urine is examined under the head of Pneumonia.

781. A *much enlarged liver*, extending upwards, is distinguished in some instances from effusion by the non-protrusion of the lower intercostal spaces (they are, however, less sunken than those of the sound side), by the normal percussion-sound superiorly, and by the tolerably full amount of respiration audible at the posterior base of the chest. The interlobular fissure of a merely enlarged liver maintains its natural relationship to the middle line of the body; that of a liver pushed down by pleural effusion (as Dr. Stokes has shown) lies at an unnatural angle with this. If an enlarged liver displace the heart, it does so in an upward, not, as pleuritic fluid does, in a sideward direction. Deep inspiration increases the area of normal percussion-sound, and also that of vocal fremitus, *below the fifth interspace* in cases of hepatic en-

largement ;—it exercises no such influence, when loss of resonance depends on effusion.

782. The *spleen*, when sufficiently enlarged to increase the width of the left base of the thorax, raises the heart,—does not, like effusion, push it aside ; extends far into the lumbar region, and forwards to, or beyond, the middle line of the abdomen, with a firm, smooth, or nodulated, surface ; affects but very slightly the amount of respiration at the posterior base of the chest, and causes no protrusion of the intercostal spaces. Splenic blowing murmur may sometimes be caught. Leucœmia, if present, will confirm the inference, otherwise deduced, as to the existence of a certain kind of splenic enlargement ; but a natural state of the white blood-corpuscles will of course not disprove the existence of increased bulk produced by other kinds of disease, as, for example, by paludal cachexia or by cancer.

783. The distinctive marks of *hydro-thorax*, *intra-thoracic tumor*, and *pulmonary cancer*, will be described with those diseases.

784. *Tubercle*, in its ordinary seat, at the upper regions, cannot be confounded with effusion, which accumulates below. If the entire lung be solid from tuberculous disease, softening and excavation signs exist superiorly, and the progress of the signs is from above downwards ; in effusion, they advance from below upwards. Loss of resonance never advances to such absolute tonelessness in phthisis as in effusion ; some amount of resilience of the parietes remains too. Semi-circular mensuration proves the existence of diminished bulk in phthisis,* of increased width in effusion. The heart, if displaced in tuberculous disease of the left lung, is carried upwards ; in effusion of the left pleura, to the right side : in tuberculous disease of the right lung, the heart may be drawn to the same side ; in right effusion, the heart is pushed to the left. Tuberculous disease of an *entire* lung does not occur without implication of its fellow ; any amount of effusion may exist in one pleura, the other remaining unaffected. In effusion the respiration is null or weak, distant and diffused blowing ; in phthisis, superficial, of various qualities, and attended with rhonchi.

785. Admitting that the presence of fluid in a pleural sac is settled beyond the possibility of cavil, and that we are equally certain pleuritis, and not simple hypersecretion, is its cause, are there any means of fixing with positiveness the *nature of the fluid*?

* In acute tuberculation with attendant pneumonia, however, this measurement may be increased. Hodson, U. C. H., *Males*, vol. ix. p. 17.

Is the given case one of pyothorax, or are the contents sero-albuminous, mixed with more or less liquor sanguinis? I know of no unfailing means of answering this question. The fallacy of supposing that bulged interspaces prove the presence of pus has already been exposed [63]. Recurring rigors depose strongly in favour of pus; the fluid is more likely, but by no means certain, to be purulent in cases marked by asthenia from the first;—so too, it is in infants and young children. The fluid may be sero-albuminous in cases that have lasted for weeks, or on the other hand be purulent, almost *ab initio*. The temperature ranges higher, when the fluid is purulent; but this is only a difference of degree.

The question can, in point of fact, be settled by the exploring-needle alone.

786. The signs of the *absorption period of pleurisy*, in active progress, cannot be confounded with those of any other disease. Pleural pseudo-rhonus [355] and pseudo-crepitation in the lung, from unfolding of its shrunken substance [344] can with very little care be distinguished from true pleuro-pneumonic crepitation, either primary or redux.

787. Pleurisy, at the *period of absorption with retraction*, can only be mistaken for affections attended, like itself, with diminished bulk of the affected side,—viz., tubercle, chronic pneumonia, cirrhosis of the lung, and infiltrated cancer. Where tubercle diminishes the measurements of the side, it does so mainly superiorly, pleurisy mainly inferiorly: the respiration-movement is greater in tubercle than in chronic pleurisy with retracted side. In tubercle, both lungs are diseased; in chronic pleurisy the organ of the unaffected side may grow extra-healthy, hypertrophous. The signs of softening of the lung are, of course, wanting in the pleural affection. The distinctive signs from the other diseases named, are given with the histories of these.

Prognosis of Acute Pleurisy.

788. Even the Registrar's reports would suffice to show that acute pleurisy is not the terribly mortal disease schoolmen formerly taught. Thus, while the returns for England and Wales give in two years and a half, taken indiscriminately, 140,096 deaths from phthisis, 47,270 from pneumonia, 19,026 from bronchitis, the quota for pleurisy is but 1994: and these figures comprise deaths from bilateral and diathetic pleurisy of all kinds.

789. That the real guide to prognosis in acute unilateral pleu-

ris is supplied by the absence or presence of diathetic or other chronic ailment, is inferrible from statements already made [763]. Little or nothing can be deduced from the temperature,—this is admitted even by Wunderlich.

Treatment of Acute Pleurisy.

790. In the acute disease, especially if the pyrexia be of sthenic character, venesection to an amount proportioned to the urgency of the symptoms, and the strength of the individual, should be employed; from a healthy male adult, from eight to twelve ounces of blood may be taken with propriety. Local depletion by leeches, or better by cupping, should follow this, if the pleuritic pain continue; and in cases of moderate severity, should be the only mode of blood-letting employed. I have not observed any more favourable results in cases where blood-letting was pushed to extremes, than where used in moderation: the risk of anemia and protracted convalescence should not lightly be incurred; and, on the other hand, the time for absolutely arresting the disease in its course has generally passed, when the patient comes under observation.*

791. Next in order, not inferior in importance, to blood-letting (evacuation of the bowels having been effected) comes mercurialisation—to a *very* slight amount—of the system: the more rapidly this influence is produced, the better: and hence, for the first six hours, small doses of calomel and opium (a grain and a half of the former to a sixth of a grain of the latter, or more, if the pain continue acute) should be given every half-hour, while mercurial ointment is rubbed, every fourth hour, into the affected side, especially near the axilla. A patient thus treated should be watched from hour to hour almost, and the moment mercurial action exhibits itself, the mineral should be stopped; ptyalism is not the object to be attained. After some twelve or twenty-four hours, small quantities of tartaremetic, or of James's powder, may be given, in combination with the mercurial, if (what is rare, on

* A boy (Henry Falkness) was admitted in the evening of January 10, 1851 (F. C. H.), with acute pain in the side, and dyspnoea. My clinical assistant, Mr. G. Webster, finding marked friction-sound on examination, ordered twenty leeches to the spot. The next day I could not detect a vestige of friction, effusion signs neither occurred then, nor at any time (the boy leaving, perfectly well, ten days after admission—he was detained thus long for purposes of observation). About the fourth day a shade of grating friction sound was caught in the old spot. Were exudation and effusion absolutely prevented here by treatment; or was the case one naturally inclined to drop short at the *dry stage*? The friction sound would formerly have appeared to me to have been too intense for the latter hypothesis; but a case already referred to [789, note], shows that friction of the most marked type may exist without exudation-matter.

the plan described) the administration of this have been required so long to produce its special mode of action. Small doses of opium and ipecacuanha at night allay cough and irritation.

792. As soon as depletion has been pushed as far as is intended, and the pyrexia has more or less completely yielded, a large blister may be applied to the affected side, but not precisely to the mainly inflamed part; its influence over yet lingering pain is sometimes most remarkable, and it probably discharges the sub-pleural vessels, by causing effusion from them, and by loading those of the skin. The application of a blister, directly over the seat of friction-sound, sometimes, it is true, removes this within a few hours, but too rapidly to justify the idea of absorption having occurred: either adhesion takes place, or a small quantity of fluid, thrown out beside and within the layers of plastic lymph, renders their collision comparatively noiseless.*

793. If, in spite of these measures, fluid continue to accumulate—or if that already thrown out remain stationary—a succession of flying blisters, none of them kept on for more than six hours—and friction with ioduretted liniments, should be employed externally, while diuretics are steadily administered internally; nitrate, acetate, and bitartrate of potass, squill, nitric æther, juniper, infusion of digitalis (the latter particularly if the pulse remain frequent) are the agents of this class commonly used. I believe the compound tincture of iodine, in scruple doses, freely diluted, to be a valuable medicine at this juncture. The action of any of these medicines is facilitated by the exhibition of blue pill, digitalis, and squill, every night, or every second night.

794. The diet should be low, and if there be effusion to any amount, much drink should be abstained from; almost enough will be taken with the saline diuretics employed.

795. The period at which paracentesis may become advisable will by-and-by be considered.

Treatment of Chronic Pleurisy.

796. The chronic disease presents itself practically under three main conditions: *first*, the thorax is retracted, the lung incapable, the side painful, the general health impaired; *secondly*, the side is

* The late Dr. Macartney, of Dublin, taught that flogging sometimes produced pleurisy in schoolboys—an opinion they would doubtless wish were generally made known to schoolmasters. If the fact be so, it would illustrate the local effect of blisters referred to in the text. If a blister be applied very close to an inflamed part, its reflex effect on that part will probably be *sympathetic*, if at a certain distance, *antagonistic*. Such effect would be in accordance with the observations of Hænic.

retracted, its wall fistulous, and a more or less profuse discharge of pus is habitual; *thirdly*, the side is permanently distended with fluid (*empyema*).*

797 (*a*). In the *first* case, art can do no more than palliate symptoms as they arise, and support the strength on general principles. Fortunately in some such cases all local inconvenience ceases after a time, and moderately good, if not robust, health is obtained.

798 (*b*). The wasting suppuration in the *second* case points to the necessity of tonic treatment: quinine, iron, and cod-liver oil, are essential to the support of the individual. Efforts may be made, by injecting the sac with slightly stimulant fluids, to alter the character of its secreting surface, and perhaps even induce its sides to cohere: ioduretted fluids are the best suited for the purpose.

799 (*c*). In the medical management of the third condition, that of *empyema*, three indications present themselves: (1) the control of febrile action; (2) the promotion of absorption; (3) the support of the general health.

800. (1.) If antiphlogistic measures have not been put in force with sufficient energy during the acute stage; if febrile action, accompanied or not with local pain, exist; and if the constitutional powers appear not to be severely depressed,—general bleeding, to a limited extent, it has been held, may be cautiously had recourse to. But it is easy to do mischief by venesection; even under the circumstances supposed, an amount of depression will occasionally follow moderate loss of blood from a vein, which may not easily be recovered from. So great has been my habitual fear of such depression, that I never resort to bleeding under the circumstances.

801. The application of some six or eight leeches once or twice a week to the side, for a week or two, is not open to the same objection; and even where local pain and febrile action are totally absent, some benefit may be obtained by the practice, provided the effusion be not of old standing. Or some three or four ounces of blood may be drawn on each occasion by cupping. But even in this mitigated degree abstraction of blood is rarely justifiable; and, it may not be out of place to add, that in my own practice it is seldom or never resorted to.

* This word has gradually been diverted from its etymological sense,—being now applied to all kinds of fluid collection, while *pyothorax* has taken its place as signifying especially purulent accumulation.

802. Is mercury advisable at this period of the disease? Certainly not, if it have already been used in the earlier stages; certainly not, if there be much wasting of the system, or if there be reason to fear that the fluid in the pleura is purulent. Under other circumstances, a cautious trial of mercury by the mouth and by inunction might be made.

803. (2.) Should the disease not yield to these measures, the promotion of absorption is to be further attempted through agents acting on the secretions; or the use of such medicines may be commenced, while the foregoing plan is pursued.

804. Iodide of potassium and liquor potassæ in full quantity, the former in doses of from five to ten grains, the latter in doses of from fifteen minims to a drachm, thrice daily, especially if care be taken that the stomach is empty when they are swallowed, sometimes very obviously reduce pleuritic effusions. But the total failure of iodide of potassium, even when pushed to repeated iodism, is unfortunately far from uncommon.

805. *Diuretics* should be exhibited in various forms: the salts of potass, especially the bitartrate and acetate (the former in half-drachm doses, or upwards), and infusion of digitalis, may be commenced with. Digitalis both acts more efficaciously as a diuretic, when administered in infusion, and appears less prone to produce those poisonous effects which occasionally result from its cumulative action. The compound tincture of iodine, largely diluted, is now, as earlier, a very valuable agent of this class. The sustained use of *purgatives* is perhaps deserving of trial, if diuretics fail; but their action, being of a more depressing kind, requires to be carefully watched. They should be very cautiously exhibited when the lungs are tuberculous, either because the intestinal walls already contain tubercle, which may thereby be more speedily brought into the stage of softening, and induce ulcerative destruction, with its consequences, of the mucous tunic; or because the irritation of the bowel in a person already phthisical accelerates the deposition of tubercle there. I have seen more than one case in which uncontrollable diarrhoea, brought into existence under the former circumstances, evidently hastened the patient's dissolution. On the other hand, dyspnoea, which has resisted various other measures for its relief, may occasionally be removed or materially relieved, and this almost instantaneously, by an active hydragogue. I have observed this from the exhibition of elaterium, even where no manifest change in the thoracic physical signs followed. *Diaphoretics* may be employed, particularly if there be occasional febrile

action; but neither in these medicines nor in *expectorants*, as promotive of absorption, can any confidence be justly placed. *Counter-irritation* of the affected side has been employed in every variety, from the mildest to the most severe. The only contra-indication to the use of agents of this class, is the presence of fever. No matter what precautions be taken, their very common tendency is to increase this, where it exists, and hence to promote a condition extremely unfavourable to the advancement of absorption. "First remove pyrexia, and then counter-irritate," is a maxim of primary importance. The application of *blisters* exercises a very manifest influence on effusions, when had recourse to with the caution just stated. They should be repeated frequently, made of large size, applied in different situations, not kept on longer than is just sufficient to produce vesication, and every means used to secure rapid healing of the blistered surface.* Employed in this way for some time—say a fortnight—blisters are often most signally beneficial; and I am the more anxious to state emphatically their utility in these cases, because the incredulity as to their efficacy in *acute* parenchymatous and membranous inflammations, now arising among the profession, might possibly be extended to their action in *chronic* maladies of the kind at present under consideration. Should any objection to the use of cantharides exist in particular cases, the tartar-emetic ointment, or a Burgundy-pitch plaster, sprinkled with tartarised antimony, may be substituted; but these are much less advantageous applications. Issues, setons, moxas, and the actual cautery, have all had their advocates and employers in the very advanced stages of the disease. The moxa is probably the most advisable of these, both positively and negatively, and may be had recourse to when the use of blisters has failed to affect the disease. The moxa will be comparatively most beneficial when the effusion is of very long standing, and attended probably with anatomical change in the bones and ligaments.

806. (3.) When the disease has become decidedly chronic, the general health is to be sustained by a succulent non-stimulant diet. Strong broths, meats of easy digestion, jellies, &c., may be taken with a degree of freedom proportional to the observed effects; and to this increasingly liberal diet may be added the use of cod-liver oil and bitter tonics, combined with small doses of nitro-muriatic acid. If these be well borne, the various preparations of iron, especially the syrup of the iodide, as also of the hypo-phosphite, should be employed. There is decidedly a stage

* Of all such means, dressing with cotton-wool is the best.

of the malady, or, perhaps, rather a condition of the organism generally, in which, although some feverish action be present, the patient will be benefited by tonics.

807. Change of air sometimes exercises a very manifest influence on the condition of patients with empyema,—primarily, it would appear, on the general health, and, through this on the effusion. The mere fact of change almost seems to suffice; for there may be no positive superiority in the new atmosphere, in which the improvement occurs, to that for which it has been substituted.

808. *Thoracentesis*.—The modes of treatment now described sometimes fail. The effusion either remains stationary or increases, and evidently must destroy the patient in the end. Under these circumstances, a resource is still left in the operation of *paracentesis*,—a procedure which, no matter how divided opinion may be respecting its general feasibility, has assuredly been sufficiently often either completely successful or productive of marked improvement, to justify its being numbered among the valuable gifts of surgery.

809. It must, indeed, be conceded that this language is scarcely strong enough, if statistics do not greatly deceive; for the results of 132 operations collected from various journals by Dr. J. A. Brady* are to be set down thus:—

Recovery complete in	79 cases.
Relief	14 ..
Death	87 ..
Effects null	1 ..
Result unknown	1 ..

The only objections of importance to these figures are, that in many instances the career of the patient was not followed sufficiently long after the operation, and that successful cases are naturally *selected* for publication.

810. The quality of the effusion has been held, since the days of Hippocrates, to influence the results of paracentesis,—success being less likely to ensue where the fluid has been purulent from the first, than where sero-albuminous. This is a dogma, however, which clearly requires reconsideration. In the first place, thoracentesis is on the whole by far the most successful in young children, and in them the fluid is almost invariably purulent. In the second, it will be seen that, without distinguishing age, Dr. Brady's subjoined table of cases gives 71 per 100 as the proportion

* New York Journal of Medicine, March, 1856, p. 271.

of recoveries, where the pleura contained pus; 40 per 100, where serum. It is possible, however, on the other hand, that some of the latter cases were really *dropsical* and dependent on organic disease, cardiac or other.

Effusion.	Total cases.	Recovered	Relieved	Died.
Pus	52	37	2	13
Serum	59	29	12	18
Sero-pus . . .	8	5	0	3
Unknown . . .	13	10	0	3

811. In respect of quantity, the less abundant the effusion, it is said, the stronger the chances of success. This is hypothetical: recovery has followed when the fluid measured several quarts.

812. Empyema running a chronic course from the outset, is generally indicative of tuberculous disease of the lungs, and is so far an unfavourable species for operation. Yet, inasmuch as the exudation-matter in such cases is very frequently friable and imperfectly plastic, and the lung therefore less firmly compressed and bound down, than when the solid exudation possesses the opposite qualities, one condition conducive to successful issue—facility of expansion on the part of the lung—is secured; and hence, doubtless, it is that, despite the counterbalancing diathetic evils, great relief and prolongation of life have sometimes been effected in such cases.

813. The operation has been much more successful in young persons, especially in children, than in those of mature years; and somewhat more so on the left, than the right, side of the chest.

814. A notion of the probable result of the operation may be had from the condition of the functions in general; if the conservative functions, digestion and nutrition especially, be only moderately impaired, the chances of recovery are of course stronger than under the contrary circumstances. It may, too, be fairly asserted that no combination of ill symptoms renders relief an impossibility. Thus in the case of a youth, whose acute seizure took place five weeks before, and in whom general anasarca, exhaustion, and all the evidences, cerebral and other, of partial asphyxia, pointed to certain death within thirty-six hours or so, the operation (the fluid withdrawn was pus of intolerable foetor), prolonged life in relative comfort for twenty days.*

815. The determination of the period of the disease most favourable for operating is of the gravest importance. Experience proves, as might have been anticipated, that when performed at

* Case seen with Messrs. Harrison, of Braintree.

an advanced period, paracentesis is rarely curative, sometimes baneful: the local changes which have then had time to arise in the pleura, pernicious as these are, are even less subversive of success than the deep constitutional distress entailed by the disease. And yet, to this period, puncture of the chest is often (in bygone days, very constantly,) postponed; it can hardly be matter of surprise, that in some such cases it has appeared to do little more than hasten death. There can be no question that the fitting time for operation has come, when a tendency, insuperable by medical means, exists either to increase or to non-absorption of the fluid. The practical difficulty is to determine the precise period at which such tendency may be considered to be developed. On the one hand, perseverance in a given mode of treatment has sometimes proved successful, when everything seemed to foretell its probable inefficacy; and on the other, valuable time may be frittered away, and the period at which paracentesis affords real chance of permanent relief but too easily suffered to pass by, from the procrastination caused by a very natural anxiety to give more gentle measures a full trial. A thorough consideration of the whole history of the case, as also of the existing local and constitutional states, is required to enable the practitioner to seize the propitious moment for surgical interference.

816. Hippocrates was doubtless right in his precept that paracentesis should not be performed before the fifteenth day of effusion,—unless the accumulation of fluid be so great as *per se* to threaten life. But how soon after does it become permissible? The actual indications for the operation may become as strong in one person at the end of a fortnight as in another after the lapse of several weeks.

817. Sédillot, a warm advocate of paracentesis under a variety of circumstances, has collected cases showing that “in the acute stage, the operation produces an excitement capable of aggravating all the symptoms, causes more or less abundant hæmorrhage, and accelerates death.” M. Gendrin, at one time uniformly operating in cases of acute effusion, was forced by the “constant death of his patients” to relinquish the practice.* On the other hand, Dr. Bowditch,† fortified by the experience derived from having performed, or witnessed, the operation in twenty-five cases, would not wait so long as three or four weeks in acute attacks, provided the effusion continued to augment. As a palliative

* Sédillot, de l'Empyème, pp. 127, 83

† Ranking's Retrospect, vol. xix.

measure, where pleurisy is connected with tuberculous or other diathetic disease, the operation seems occasionally to have relieved in the acute stage,—more frequently to have placed the patient in a worse position than before.

818. There can be no doubt of the necessity for paracentesis where asphyxia, or, as is less uncommon, syncope, is threatened by the copiousness of effusion; but such form of danger it has very, very seldom occurred to me to witness in the acute stage of the simple unilateral disease,—and a tolerably extensive experience therefore justifies me in assuming that the dilemma rarely arises in actual practice. Still I have seen a strong man, proved by dissection to be free from any other kind of disease, unexpectedly perish from syncope under the influence of unilateral effusion. In this instance the quantity of fluid was very great; but it seems not impossible from the observations of Dr. W. Begbie, that idiosyncrasy may sometimes involve the risk of death by syncope, when the amount of effusion is very moderate.

819. Many practical physicians have held that, if the pleural contents be purulent, not a moment should be lost in giving vent to them by operation; this opinion, if well-founded, would involve as a necessity the use of the exploring-needle at the commencement of every case, seeing that by it alone can the nature of the fluid be learned [786].

820. If abundant effusion on one side be associated with single or double pneumonia and general bronchitis, and, depletion having been carried as far as permissible, urgent dyspnoea continue, temporary relief at least will be obtained by paracentesis, and time thus gained for the action of remedies. And should effusion occur on the hitherto healthy side, its fellow being seriously retracted by the chronic disease, prompt removal of the fluid by operation is positively indicated.

821. Do statistics help us to a definite opinion as to the fitting moment for operative interference? Unfortunately of the 132 cases collected by Dr. Brady, there are 55 in which the duration of the disease was unrecorded; and among the 37 cases of deaths, the time of the fatal issue was unknown in 19. However, the following numerical results may be obtained from his facts:—

Duration of disease	Number of operations	Number of deaths	Ratio.
Under two months	34	3	8.8 per 100
Under four months	20	6	30.0 per 100
Under nine months	13	6	33.3 per 100

The authority of figures is then added to that of unanalysed experience in favour of moderately early operation.

822. The operation having been determined on, if the faintest lingering doubt exist as to the precise nature of the case, a delicate exploring needle should, as a measure of precaution, be first introduced into the pleura: if the expected fluid appear, the operation may be continued with a medium-sized trochar or a bistoury. The trochar is certainly the more advisable instrument, if the intention be to evacuate the fluid by degrees,—an intention which we believe Laennec to have been right in commending, when the patient is so debilitated as to justify an apprehension that the complete discharge of the liquid might be followed by dangerous syncope; and when paracentesis is merely performed with palliative intent in advanced tuberculous cases. Even when the design is to remove at once as much as possible of the fluid, the results have on the whole been most favourable with the trochar.

823. The first point to be ascertained, in selecting the place for the performance of the operation, is the adherence or non-adherence of the lung to the chest, and, in the former case, if possible, the precise limits of the adhesions. It is scarcely necessary to say, that the site of these must be carefully eschewed. When the entire side is free from adhesion, the common advice of surgical writers has been, that the opening be made at the most dependent part of the antero-lateral part of the chest. But indiscriminating attention to this advice, given with the sole view of securing free egress for the pleural fluid, has occasionally led to perforation of the diaphragm and abdominal viscera; even the kidney has been extensively wounded by operators whose practice is to adhere too scrupulously to such injunctions. Laennec recommended the fifth interspace, a little in front of the digitations of the serratus magnus muscle, as the fittest site for puncture. The importance of opening the fifth instead of a lower space, has been justly insisted on by Drs. Townsend and Stokes, who draw a fair analogical argument in favour of high puncture from the elevated position in which the discharge commonly occurs, when spontaneous or preceded by the formation of abscess: the opening has, then, sometimes taken place even above the clavicle.* If the ribs cannot be clearly distinguished on account of the presence of marked cedema, some difficulty may arise in fixing upon the spot for incision. Steady and continued pressure with the pulps of the fingers will sometimes enable the operator to discover the

* Spontaneous opening sometimes occurs even as low as the abdominal wall.

edges of the bones in cases where this would on first view have appeared altogether impossible.

824. The place for operation having been duly determined on, a horizontal incision should be made through the integuments for the introduction of the point of the trochar. Care should be taken not to carry the instrument too close to the borders of the ribs, lest the corresponding branches of the intercostal artery be wounded.

825. If the operator have been unfortunate enough to incise the pleura over the site of firm, thick, and strongly adherent pseudo-membrane, and in consequence no fluid appear, the line of conduct to be further pursued must vary with his confidence in the correctness of his diagnosis in other respects. If he still remain satisfied of the presence of liquid effusion, the attempt to evacuate this may be proceeded with: if he be apprehensive of having altogether erred, the obvious course is to dress the wound, and avert, as effectually as possible, the ill effects of the unnecessary suffering to which the patient has submitted. In the former case, surgeons have attempted to tear asunder the pleural adhesions, a procedure utterly unjustifiable: the only admissible modes of acting are, to enlarge the existing opening with the bistoury, or to make a new one. The opening may be enlarged, if the free border of the membranous mass interfering with the escape of the fluid be ascertained to be perfectly close to the angle of the existing wound: under other circumstances, a new incision must be made, under the guidance of the exploring-needle.

826. Two other methods of opening the chest are, 1, by *perforation of a rib*; and, 2, by the *formation of an eschar*, either by the actual or potential cautery.

827. The plan of perforating a rib with a trephine constructed for the purpose, fallen into disuse since Hippocrates, was some while since revived by Reybard. The object of this surgeon, in recurring to this antiquated practice, was to ensure a solid support for a canula, which he proposed leaving in the pleura, as a sort of drain for, or, at least, means of removing at will, any new accumulation which might arise. A case thus treated, previously operated on in the ordinary way, terminated favourably; and neither caries nor necrosis of the bone appear to have complicated its progress. From this single case it is, however, impossible to draw any safe inference as to the general expediency of the plan.* The "drainage" plan of Chassaignac seems here to be anticipated.

* Gazette Méd. de Paris, Janv. 1841

828. Modern surgery repudiates the idea of opening the chest by an eschar produced with the actual cautery; and we can imagine no advantage gained by substituting caustic potass for the trochar or bistoury, while numerous very serious objections to such a procedure manifestly exist. Nevertheless, in cases where an external abscess has formed, and in these alone, the opening in the skin may, if the patient be excessively timorous and impressed with a dread of cutting instruments, be made with a piece of caustic potass.

829. Many writers lay very great stress upon the importance of preventing the occurrence of pneumothorax;—hence the invention of various modifications of the common canula, constructed with the view of ensuring the non-entry of air. Some of these have invariably, others occasionally, been found failures. The proposed plan of puncturing the chest under water would entail difficulties and dangers of its own. And though it need not be questioned that the entry of air is for obvious reasons to be deprecated, the great anxiety on the matter is evidently overdone: in numerous instances, where the physical signs of pneumothorax were distinctly detected after the operation, recovery has ensued.

Speculative reasons may and have been, by various persons, adduced in numbers in favour of complete evacuation at once or of successive small drainings; the important point to remember is, that with the exception already mentioned [822], experience is in favour of as complete evacuation as possible. Curiously enough, many of the advocates of successive evacuations are at the same time energetic in denouncing the ill effects of pneumothorax; how they reconcile to themselves the recommendation of a mode of operating which doubles, trebles, quadruples, or even still further increases the chances of the entry of air, does not very clearly appear.*

830. The proposal to ensure the removal of the entire collection of fluid, by drawing off with a syringe any portion of it which gravitates below the opening, is as old as Scultetus. Laennec advised the use of a cupping-glass and exhausting syringe, with the view of draining off the last remains of the fluid, and facilitating the expansion of the lung.†

* It has been shown, too, by Bartholomy, that air may be admitted once into the pleura of the horse with impunity; but that repeated admissions cause bad inflammation (*Bull. de l'Acad. de Med.* &c.).

† A very ingenious instrument for the purpose is made by Coxeter, of Grafton-street East.

831. The changes induced by the operation are, or may be, of two kinds; *curative* and *pathological*.

832. The *curative* class, which are local and general, are as follows: the diminution of the contents of the chest is, of course, attended with decrease in the dimensions of the affected side. In a case observed by Dr. Townsend, the semi-circumference, which reached 16½ inches before the operation, had fallen to 13¾ inches on the ninth day after it. The approximation of the pleural surfaces is rendered manifest, sometimes at a very early period, by the occurrence of friction-phenomena; the patient is frequently enabled to lie on either side on the day, or even a few hours, after the operation: his dyspnoea is immediately relieved; the state of anxiety under which he laboured disappears; the urine increases in quantity; and a sound sleep, the first, possibly, enjoyed for weeks, commonly follows the evacuation. Clubbing of the finger-ends may lessen in amount. The temperature is said to fall after thoracentesis, if the fluid be purulent,—to remain stationary, if serous. Even in cases eventually terminating fatally, and terminating fatally through the influence of the operation, all its immediate results may be of this favourable character.

833. Of the *pathological* effects, as they may be termed, of the operation, pneumothorax is the most inevitable: the question of its influence on the ultimate issue of the case has already been referred to. The continuance of secretion from the pleural surface for a greater or less period, and hence the constant renewal of empyema, is of very common occurrence. In rare instances, the characters of the newly secreted fluid remain those of that originally evacuated; in the great majority they change, the general tendency of the change being to the purulent character. The alteration from the almost purely serous appearance to the purulent is sometimes accomplished in twenty-four hours. When the fluid has been originally more or less completely formed of pus, but of a laudable kind, its conversion into a purulent matter, of bad quality and fetid smell, is not unusually observed. Under these circumstances the injection of warm water or some other unirritating fluid becomes advisable. Should there be much appearance of putrescency, a small quantity of very dilute liquor sodæ chlorinatæ ought to be added.

834. In the ordinary course of things, when the case is destined to end by the patient's restoration to health, the wound or wounds in the thoracic walls gradually close, and cicatrization is perfect within a short period: but occasionally the opening, instead of

closing, acquires the characters of a fistula, which it retains for a variable period, and daily gives issue to more or less pus.

835. When spontaneous perforation of the costal lamina has occurred, and a portion of the contents of the pleura escape through the opening into the subcutaneous cellular membrane, and form an abscess there, this should be opened without delay, in order to prevent the occurrence of sinuses and burrowing: so well established is this point, that the operation is under these circumstances termed *paracentesis of necessity*. The prognosis of paracentesis, as far as the operation goes, is, in this exigency, favourable above the average.

836. Cases of *double empyema* are, as a general rule, unfit for operation, unless evacuation be rendered necessary for the prevention of asphyxia. Should particular circumstances arise, under which paracentesis might on other grounds become admissible, an interval of time, varying in length with the condition of the patient, must be allowed to elapse between the two operations.

Empyema with bronchial fistula.—In cases of this class little is to be done medically, whatever have been the original mechanism of the empyema [774], beyond a full employment of the means already indicated for the treatment of empyema generally [779]. The free inhalation of carbolic acid will greatly reduce the stator of the breath and discharge, and probably modify the condition of the intervening bronchial mucous membrane.

I have no experience of paracentesis under these conditions: and should very certainly hesitate to enjoin its performance unless as an *ultima spes*.

In a case of this kind a complete cure was ingeniously effected as follows: Mr. Malcolm, having noticed that the patient instinctively bent forward to get rid of the expectoration, conceived the idea of turning him upside down. The result of the change of posture was the discharge of about a quart of horribly offensive pus through the mouth; gradual improvement, local and general, and apparent restoration to health in three months after the original seizure, are stated to have ensued.*

837. It is to be remembered that in the statements now made concerning thoracentesis, truly inflammatory effusions have alone been held in view: its applicability in hydrothorax is elsewhere considered [882].

838. The operation having been performed, and the fluid eva-

* Brit. Med. Journal, Jan. 1866. The case reminds one of Sir B. Brodie's removal of a coin from the larynx by a similar device. Med. Chir. Trans.

euated as completely as possible, the ulterior mode of proceeding may vary in four different ways. (*a*) The wound may be closed at once; (*b*) it may be kept open, and some system of constant drainage put in force; (*c*) it may be kept open, the re-accumulating fluid being drawn off more or less frequently; (*d*) it may be kept open and utilised as the channel for the injection of various fluids into the pleural cavity.

839. (*a*) Immediate closure of the wound may be effected when the conditions of the attack, the constitution of the patient, and the completeness with which the sac has been emptied, render reproduction of the fluid of less than average probability.

Should the fluid be reproduced, it may be again and again removed with eventual perfect recovery. This is particularly true in childhood. I have recently seen with Dr. Charles West an anæmic, delicate boy, aged six, in whom paracentesis was performed five times in the course of two months, the fluid having been purulent from the first; a canula was kept in the wound on the last occasion for five weeks, without counter-opening. The quantity of fluid (on the left side) was sufficient to drive the heart under the right nipple; and, singular to say, recovery has taken place without perceptible retraction of the side.

840. (*b*) The system of drainage, introduced by Chassaignac and modified by Dr. Goodfellow and Mr. C. De Morgan, has seemed on the whole successful, and may with advantage be employed when it proves impossible to empty the sac completely, and when the fluid is at the same time purulent.

841. (*c*) The removal of freshly accumulated fluid may be effected through a simple canula, the frequency of the removal being regulated by circumstances. I had a patient under observation for upwards of a year, who was in the habit of pumping out some five or six ounces of pus every third or fourth day: what eventually became of him I do not know, but I last saw him in fair condition. The well-known case of Dr. Wendelstadt, who daily for thirteen years drew off some pus from the sac and preserved excellent health, is probably the most remarkable one of the class on record.

842. (*d*) Great relief is sometimes given where the surface is irritable by the injection of tepid water, or some bland infusion. Should there be much appearance of putrescency, a small quantity of very dilute liquor sodæ chlorinatæ, or of the glycerol of carbolic acid should be added. Although the notion of giving tone to, and diminishing the irritation of, the diseased pleural surface by

injections of tonic and alterative preparations, seems, on first view, of questionable justice; and although the practice has certainly not been attended with sufficiently favourable results to warrant its general employment; yet a fair number of cases are recorded, showing that ioduretted solutions at least may, under certain circumstances, not only be injected with impunity, but with the effect of completely curing empyema of long standing. M. Boinet, in particular, relates cases of this fortunate issue.* The proportions of tincture of iodine and iodide of potassium varied, in these cases, between ten and fifty of the former, and one and four of the latter, to a hundred parts of distilled water. Severe iodism may follow the use of the stronger preparation. The injections may be repeated once, twice, or thrice a week, according to circumstances.

VARIETIES OF PLEURISY.

843. The varieties of pleurisy may be arranged according to the following plan:

I.—*Idiopathic.*

Seat of the disease	{	Unilateral; bilateral.
		Unicameral; locular; multilocular.
Objective or subjective course	{	Circumscribed; costal; pulmonary; phrenic; mediastinal; interlobar.
		Obvious; with subjective suffering.
Mobility of the fluid	{	Latent; without subjective suffering.
		Pulsating { Subcutaneous, Intra-pleural.

II.—*Secondary.*

Attending acute epidemic diseases	{	Typhoid, typhus, eruptive, and puerperal fevers.
Attending chronic diseases	{	Scrophula; Bright's disease; rheumatism; gout; scurvy; purpura, pyæmia.
Caused by adjacent irritation	In the lung	Pneumonia; abscess; tubercle; cancer, gangrene; hydatids.
	In the adjoining organs	Stomach; liver, spleen, pericardium, mamma.
Traumatic	{	Contusions, wounds, and surgical operations on the chest wall, perforative and non-perforative, with or without entry of foreign bodies, fracture of ribs or clavicle, hæmothorax.
Perforative	Through lung	Tubercle, abscess, cancer, gangrene, vesicular emphysema; hydatids; foreign bodies from without.
	Through diaphragm	Cancer of stomach, œsophagus and liver; hydatids of liver, chronic pyelitis.

* Archives Gèn. de Méd. et., M., 1853.

844. It appears from this scheme that, under a multitude of different circumstances, pleurisy is a disease for which the physician should be on the watch. The peculiarities of some of these varieties have already been spoken of; certain others will be considered with the diseases producing them; in the present place, a few only of the number will be briefly dwelt on.

A. — BILATERAL OR DOUBLE PLEURISY.

845. Although primary pleurisy is essentially unilateral; while the implication of both pleura almost surely signifies the existence of diathetic mischief, still bilateral pleurisy does, though very rarely, occur in persons the most thoroughly healthy and the most perfectly free from constitutional taint of any kind. This important truth appears to have escaped the notice of systematic writers.

846. I have seen such idiopathic bilateral pleurisy in young adults of both sexes, as well as in persons advanced in years. In all the cases (four in number) common cold, in connection with emotional excitement, had acted as the exciting cause.

847. The gravity of the seizure is enhanced by (as far as I have seen) the certainty, that the pericardium will become involved: in one of my cases the peritonæum followed. There is obviously a proclivity to general serous inflammation. The lung-substance, wholly free at the outset, sometimes becomes slightly and superficially implicated at the close.

It is important to state that in all these cases the absence of albuminuria was ascertained.

848. The prognosis is most serious: in every instance, of which I have had cognisance, the result was fatal. Death does not take place with the rapidity that might be anticipated,—a fact which, in the cases I have met with, was clearly referrible to the inflammation having remained in the plastic stage longer than is usual in the unilateral disease.

849. In two cases, the most antiphlogistic treatment, in two others, mixed mild antiphlogistic and stimulant measures, failed to cure, though they stayed the progress of the disease. Paracentesis is plainly inapplicable.

B. — CIRCUMSCRIBED PLEURISY.

850. The portion of pleura inflamed may be limited: the disease is then said to be circumscribed, and may present itself in different localities.

PHRENIC PLEURISY

(1.)—PHRENIC PLEURISY.

851. The tract of pleura covering the diaphragm m. solely or specially affected.

852. *Symptoms*.—The pain, unusually severe, grows agonising under the influence of full inspiration, is increased by certain movements and attitudes, corresponds accurately to the anterior insertion of the diaphragm, or extends downwards laterally (the peritoneal coating, as I have once seen, may then be suspected to be inflamed also), and varies in amount inexplicably from time to time. In rare instances the pain has been slight throughout: in such cases does the muscular substance escape [546]? The cough is generally paroxysmal.

853. Hiccup, nausea, and vomiting, though occasionally observed, may be wanting, even though the phrenic peritoneum be implicated. Occasionally hiccup may be induced by slight pressure at the epigastrium, when absent as a spontaneous act. Jaundice, noted once by Andral,* where the right pleura was affected, is not assimilable to the jaundice occasionally attending acute pneumonia, and can only be regarded as accidental. *Risus Sardonicus* has not fallen under my notice. Even though the central tendon be involved, pericarditis does not necessarily ensue. There may or may not be co-existent pneumonia, intense congestion, or (with dilated flabby heart) apoplexy of the adjacent base of the lung.

854. Orthopnœa, with the trunk bent forwards, is on the whole frequent: but, even though the heart be obstructed and the lung congested in addition, the patient from time to time derives most ease from various reclining postures.

855. Intense anxiety, and distressing fear of impending dissolution, combined, if the pyrexia be high, with delirium, in some instances give a very grave aspect to the case.

856. *Physical Signs*.—Excess of general costal movements on the unaffected side; excess of upper and middle costal movement on the affected side with limited quantity of breath-sound; percussion-note not markedly heightened in pitch; absence of rhonchus and of friction-sound: make up the observed chest signs, positive and negative.

With these is noticed absence of abdominal movement; the diaphragm is by consensual action kept still. Should the muscular fibres themselves become paralytic under the influence of the adjacent serous inflammation, the perverted rhythm of costo-

* Clin. Medical, vol. ii. obs. xix.

abdominal movement, known as Duchenne's sign, would probably be discoverable [547].

857. *Diagnosis.*—I believe it to be impossible to detect friction-sound so long as the exudation is really confined to the phrenic and corresponding pulmonary surface. And life may be prolonged for several days without effusion of fluid. Hence the diagnosis is commonly an indirectly inferential process formed essentially on the more or less complete union of the *symptoms* described.*

858. The frequency of phrenic pleurisy is obviously greater than is generally supposed; the perpetual detection of old adhesions in this situation is a sufficient proof of the fact. The agonising pain of some common pleurisies has appeared to be referrible to extension of inflammation to the phrenic surface and substance of the diaphragm [546]. But it is certain, if Andral may be trusted, that pain may be of the most violent kind, without the muscular tissue being affected.

859. *Prognosis.*—Pleurisy in this situation frequently occurs without serious results,—but some observed cases prove that it has occasionally destroyed life in healthy young persons free from organic disease of any kind.

(II.)—MEDIASTINAL PLEURISY.

860. Inflammation of the mediastinal pleura is often accompanied with serous infiltration of the cellular tissue of the mediastinum itself; bubbling pseudo-rhonchus will then be heard along the sternum.

(III.)—INTER-LOBAR PLEURISY.

861. Pleuritic fluid accumulation, confined by adhesions between the lobes of a lung, may simulate a solid mass in the pleura or in the lung itself, or an aneurism. Dull percussion-sound, local bulging, weak or bronchial respiration, with vocal resonance, may exist in all three cases.

862. But the pleuritic accumulation lies in the line of the inter-lobar fissure of the lung; the voice may have an ægophonic twang on its confines; there is no vocal fremitus over it; there is neither impulse nor vascular murmur; and the affection has a commemorative history, different from that of the other diseases named.

(IV.)—LOCULAR PLEURISY.

863. Local sero-purulent collections may form, encircled by a boundary of adhesions in any part of the pleural surface, and

* Case of J. S., seen with Dr. Mukham.

several such may co-exist, forming sacs perfectly independent of, or communicating with, each other,—whence bilocular or multilocular empyema. The adhesions forming the walls of these loculi of course unite portions of lung-substance to the surface, and so give rise to various modifications in the physical signs.

864. The general character of these modifications is, that wherever adhesions exist, blowing respiration is heard; and if a portion of lung, of any size, even though condensed, be agglutinated to the surface, the percussion-sound will have more tone, conjoined sometimes with wooden or tubular quality, than directly over the fluid. The state of vocal resonance varies. I have, on the right side, found the vocal fremitus perfectly retained over such portions of condensed lung.

865. Individuals who have been the subjects of extensive loose adhesion, undergoing subsequent attacks of pleural inflammation, present the signs of these multilocular collections in perfection. Isolated patches of surface, simultaneously or successively, and in positions the most unconnected, furnish the signs of exudation, effusion, and absorption, while intervening islets of the chest-wall remain perfectly free from any such signs. In one remarkable case of this kind, four successive attacks of pleurisy, occurring within a period of five months, were thus characterised.

C.—LATENT PLEURISY.

866. Pleurisy is said to be latent when it runs its course without producing decided subjective symptoms,—when there are neither local pain, cough, dyspnoea, nor febrile action. In cases of this kind, effusion may have reached to the clavicle, and driven the heart greatly out of its place, and yet the patient remain utterly unaware that his chest is the seat of disease. He seeks advice, either from a vague consciousness that he is not in his usual health, or for some ailment totally unconnected with the thorax. The physical signs reveal the true condition of things.

867. The necessary treatment, once the disease is detected, is not modified in any important point (except that blood-letting is, as a rule, wholly inapplicable) by this latency of course; the great difficulty often consists in persuading the patient that there is really anything of a serious character to treat. I have repeatedly known persons with copious effusions of this kind follow their usual, more or less laborious, occupations.

It has been held, but so far without proof, that these cases are peculiarly favourable for early thoracentesis.

D.—SUBCUTANEOUS PULSATING EMPYEMA.

868. Empyema, forcing its way through the costal pleura, may form one or more swellings under the skin, which rise and fall, if the parietal communication be free, with the acts of expiration and inspiration.

869. This respiratory pulsation has long been known. But, some years since, Dr. M'Donnell showed, what had not been previously recognised, that a sub-cutaneous purulent collection of the kind may pulsate synchronously with the heart, strongly and expansively, and hence simulate an aneurism. The absence of thrill and of abnormal vascular sound or murmur, the presence of the ordinary signs of empyema, and often the situation of the pulsatory prominence, will clear up the diagnosis. For fuller information, the valuable paper of Dr. M'Donnell may be consulted.*

E.—INTRA-PLEURAL PULSATING EMPYEMA.

870. But an empyema may become pulsatile under circumstances more singular than these, and still more likely to confuse the practitioner,—I mean where there is no perforation of the costal pleura, and no accumulation of pus under the skin. I have twice, in cases,† presenting all the ordinary physical signs of empyema on the left side, with displacement of the heart to the right, seen the inner part of the infra-clavicular and mammary regions close to the sternum, pulsate visibly, heavingly, and with sufficient force to jog the head at the end of the stethoscope,—the aorta, as proved by *post-mortem* examination, being of natural calibre. In both cases, while the side generally was greatly dilated, gentle local bulging was manifest in the site of the pulsation.

871. *Diagnosis*.—The circumstances that determined the diagnosis in favour of pulsating empyema, were the absence of vascular murmur at the seat of pulsation; the fact that the two sounds heard at this spot were very weak, and gradually increased in in-

* Dublin Journ. of Med. Science, March, 1844

† The first of these cases was seen (April 3, 1843) in consultation with Sir James Clark and Mr. Keighly. In this instance the diagnosis was made *per viam exclusionis* and suggestively only. The total cessation of pulsation on the reduction of the pleural fluid rendered its correctness tolerably certain, but the seal of absolute certainty was set upon it some months later, when the patient dying of dysentery the aorta was found to be perfectly healthy. Shortly after the first edition of this work was published, I had the gratification of receiving from Mr. A. Kemp, of Exeter, the particulars of a case observed by himself, successfully identified through the description in the text. In Mr. Kemp's very interesting case the pulsation was perceptible even at the upper two thirds of the left back, as well as below the clavicle. I have up to the present time (1871) met with six examples of really well denned pulsation of this kind.

tensity, as the stethoscope was carried towards the heart; the absence of thrill below and above the clavicles, and of undue impulse in the latter situation; the perfect equality of the radial pulses; and the total absence of signs of concentric pressure, venous, tracheal, or oesophageal. Taken singly, no one of these characters could be held conclusive; but the entire series formed a most serious body of evidence against the admission of aneurism. In both instances, the pulsation disappeared with the absorption of the fluid, and the return of the heart to its natural position: death arose from independent causes.

872. In both the cases referred to the pulsatile character was already present when I first saw the patients: the diagnosis would be easier, if impulsive action of the kind made its appearance in a case of empyema while under observation; the sudden occurrence and great amount of the phenomenon, unattended with any of the ordinary evidences of aneurism, would combine to guard the physician against error.

873. Pulsation conveyed to empyema, and simulating that of aneurism by its force and heaving character, seems to be merely an excess of the slight fluctuation-movement in the fluid, which is not very uncommon in ordinary cases.

P.—PLEURISY CONNECTED WITH MAMMARY CANCER.

874. Among the most frequent secondary morbid states, in cases of cancer of the female breast, stands pleurisy,—with or without cancerous patches under the pleura. Where sub-pleural cancer is not present to act as a direct irritant of the serous sac, it is probable the low inflammatory action, on the confines of the diseased gland, travels through the intervening tissues to that membrane. The relative frequency with which, after extirpation of the diseased breast, pleurisy on the implicated side proves the immediate cause of death, lends support to this view.

III.—HYDROTHORAX.

875. Hydrothorax, dropsy of the pleura or accumulation of serous fluid without inflammation-products, occurs actively, passively, or mechanically.

876. Of the *active* or *irritative* kind is the true hydrothorax, occasionally putting the close to existence in cancer of the mamma, and also occurring, instead of actual pleurisy, in some cases of Bright's disease: on the whole, this variety is very rare.

I have never yet met with an effusion of this kind in a person demonstrably free from organic disease or diathetic vice. In other words, I have never seen primary idiopathic hydrothorax. Singularly enough Laennec, who professed to have done so, gives only two cases in support of the view, in both of which there was grave cardiac disease.

877. In the great majority of cases, hydrothorax is *passive* or *mechanical*, and either occurs as an element of general dropsy, or is produced by obstructed circulation through the lungs and heart,—especially through the right side of this organ and tricuspid orifice, or, sometimes, by that most rare disease, aneurism of the pulmonary artery.

878. *Symptoms.*—In hydrothorax the pain and “stitch” of pleurisy are wanting, and there is no tenderness under pressure. There is less cough, and may actually be none. But the mechanical effects of hydrothorax are often more serious than those of pleuritic effusion, for the simple reasons, that hydrothorax is generally bilateral, and sequential to more or less serious organic disease, already disturbing the respiration and circulation,—pleurisy, on the contrary, very often unilateral and primary. Hence the dyspnoea may be excessive, with constant orthopnoea, and extreme lividity of the face, anxious countenance, clammy perspirations, and coolness of the expired air. If the patient can lie down, he does so on the back, with slight inclination now to one side, now to the other.

879. *Physical signs.*—The physical signs agree in some, disagree in other points, with those of pleurisy. Dulness under percussion, moveable in area, with the changed posture of the patient—and more readily moveable than in pleurisy on account of the absence of adhesive material; distant, weak, or suppressed respiration; bronchophony, occasionally egophony or complete deficiency of vocal resonance; total loss of vocal fremitus, and occasionally peripheric fluctuation, are common to the two affections. But in hydrothorax there is no friction-sound or fremitus, and both sides are commonly affected, while in pleurisy one only generally suffers. Dilatation of the side and flattening of the intercostal spaces may exist in both diseases, but relatively reach a higher point in the inflammation than in the dropsy. The heart and mediastinum are but little displaced sideways in hydrothorax, because the disease is generally bilateral: even if one side only be affected, the displacement is less easily effected in this affection than in pleurisy; possibly because the relaxing effort of inflam-

mation on the serous tissue is wanting. The diaphragm may be very considerably depressed.

880. In rare instances hydrothorax has been known to disappear, as presumed in the analogous case of empyema [767], by a metastatic serous flux from the bronchial tubes.

881. *Treatment.*—If the dropsy be of the irritative kind, moderate cupping is beneficial, unless some distinct contra-indication exist; under all circumstances, dry cupping is advisable. If there be no marked oedema of the walls, the chest should be blistered. Painting the surface with tincture of iodine, or iodurated frictions, sometimes obviously promotes absorption. The internal remedies are diuretics and purgatives: claterium proves highly useful occasionally.

882. Inasmuch as hydrothorax is commonly either a local manifestation of a diathetic disease, or the effect of irremediable mechanical mischief in the heart, little, as a rule, can be expected from paracentesis,—at least in the way of permanent cure. But great temporary relief, and even prolongation of life, may be secured in urgent cases by the operation; and where asphyxia is threatened by double hydrothorax, it is obvious that puncture, on one side, should at once be had recourse to.

IV.—PNEUMOTHORAX AND HYDRO-PNEUMOTHORAX, INCLUDING PERFORATION OF THE LUNG.

883. By pneumothorax is understood accumulation of gaseous fluid in the pleura; the various modes of its production, proven and alleged, may be classified as follows:

- I. *No communication existing between pleura and outside air.*
 - (1) Gangrene of pleura. (2) Chemical decomposition of pleural fluid; (3) Air replacing sero-purulent fluid, suddenly absorbed; (4) Secretion by pleura.
- II. *Communication between pleura and alimentary canal.*
 - (5) Rupture or ulceration of stomach, or of oesophagus, into pleura.
- III. *Communication with atmosphere through opening in chest wall.*
 - (6) Penetrating wounds of thorax, accidental and in thoracentesis.
- IV. *Communication between pleural sac and bronchi.*
 - a. *Traumatic.*—(7) Flaring of lung surface by broken ribs; (8) Violent contusion of chest, tearing lung without costal fracture.
 - b. *Pertussive (from disease opening the pulmonary pleura from within outwards or vice versa).*—(9) Tubercle, (10) Gangrene, (11) Diffuse pulmonary apoplexy, (12) Hydatids; (13) Cancer; (14) Emphysema; (15) Abscess, (16) Rupture in perusses; (17) Excavated bronchial glands opening into the pleura and bronchi.
 - c. *Pertussive (from disease opening the pulmonary pleura from without inwards or vice versa).*—(18) Empyema, (19) Parietal abscess.

884. (Class I.)—Gangrene of the pleura and decomposition of solid or fluid materials within its cavity act, in excessively rare

instances, as the causes of non-perforative pneumothorax. It has been held admissible, again, as a bare possibility, that, in those very exceptional cases of pneumonia, where true tympanitic resonance exists directly over the hepatised parts, that quality may be contributed by air secreted by the pleura. For my own part I wholly disbelieve the presence of air under the circumstances [217]. Of any other kinds of simple pneumothorax I know nothing clinically; nor have I ever seen a case justifying belief in the real existence of general idiopathic pneumothorax.* It has been taught on the evidence of a case recorded by Itard, that absorption of purulent matter may directly entail exhalation of air by the serous membrane. An old sufferer from empyema died with little pus and much gas (the latter, judging from the signs, of about three weeks' duration) in the pleura. The gas was of excessive foetor, not, however, it is held, from primary decomposition of the pus, but from chemical changes induced in healthy pus by gas originally odourless: this explanation is purely hypothetical.

885. (Class II.)—Rupture and ulceration of the stomach and cesophagus have in very rare instances led to escape of gas into the pleural sac; but the resulting pneumothorax is, under the circumstances, a matter of most secondary importance.

886. (Class III.)—Penetrating wounds of the thorax belong to surgical practice,—and enough has already been said on the pneumothorax produced by thoracentesis [829].

887. (Class IV.)—(a) Traumatic cases belong to the surgeon.

888. (b. c.) Perforative pneumothorax most certainly presents itself under all the varieties of mechanism set forth in the Table, but some of these forms are infinitely rare, —few of them common; and in point of fact it seems highly probable that 90 per cent. or thereabouts, of the total number of actually observed cases of pulmonary perforation, are really affiliated to extension of tuberculous ulceration through, or to tuberculous rupture, of the serous membrane.

It is true that of 147 published cases of pneumothorax, collected

* It has been too much the habit at post-mortem examinations to pronounce pneumothorax idiopathic, whenever a superficial examination of the surface of the lung fails to detect an opening in the pleura. A crease in the substance of the organ, or a patch of exudation matter, will effectually conceal even a good-sized opening from view. The only trustworthy test is afforded by insufflation of the lung from the main bronchus under water. And supposing this test fails, it simply proves the absence of existing free perforation; such perforation may have existed, and have been closed up completely in a few days, as careful dissection of strata of exudation-matter has frequently proved.

by M. Saussier,* eighty-one only were phthisical. But tuberculous perforation is, relatively speaking, an every-day affair, which passes unrecorded: perforations from gangrene, vesicular emphysema, hydatids, pulmonary apoplexy, aneurys, and other very rare causes, are greedily caught hold of, and registered. The number of the latter published, consequently, gradually swells out of proportion with their actual comparative frequency.

890. The clinical and anatomical history of perforative pneumothorax is, consequently, in the main, represented by that of tuberculous perforation.

890. *Tuberculous perforation*.—Of eighty-seven cases of tuberculous perforation (seventy-four collected from various authors, thirteen observed by myself) fifty-five were examples of the occurrence on the left, thirty-two on the right, side. The pleura commonly gives way postero-laterally in the area comprised between the third and sixth ribs. Perforation may occur at all periods of tuberculous disease,—and though commonly connected with the excavating process, sometimes depends on fresh depositions directly beneath the serous membrane. M. Louis records a case, where the pleura gave way, perforated by a small softening tubercle immediately beneath it, in a fortnight after the first appearance of phthisical symptoms. The occurrence is consequently to be looked for, as a possibility, at any period of phthisis.

891. The largest opening, I have seen, equalled a fourpenny piece in diameter, the actual dimensions having been probably increased in the manipulations necessary for the removal of exudation-matter: the smallest was not larger than a pen's head. The form is rounded or chink-like, and the communication with the air-passages direct or sinuous. The wider and more direct the perforation, the freer on the one hand becomes the entry of air in inspiration into the pleural sac; while the greater the chance on the other hand of some of that, actually effused, making its way back with the reflux of the tidal air. As matter of experience, the sac fills most rapidly, where the opening is small and sinuous: or where exudation-matter, loosely applied to the surface, permits the entry, but effectually bars the exit, of air through the valve-like aperture.

892. I have met with an example or two of double opening on the same side.† But it has not occurred to me to witness *bilateral*

* Theses de Paris, 1841.

† Healey, U. C. H., Females, vol. x. p. 163; also Nicholson, U. C. H., Males, vol. xvii. p. 160.

times bathed in cool clammy perspiration. The voice habitually loses strength greatly, and almost complete aphonia has sometimes been observed. Oedema of the affected side of the thorax is, at the least, very rare, before pneumothorax has been accompanied, and this for some time, with pleuritic effusion. In the case of rapid death already referred to, copious hydropericardium, amounting to nine ounces and a half, obviously hastened the fatal issue: the pneumothorax was on the right side, the lung flattened against the spine. Was this a mechanical dropsy of the pericardium caused by sudden pressure on the venæ cavæ and right side of the heart?

900. *Physical signs.*—(a) *Pneumothorax.*—The physical signs of pneumothorax are very significant. The chest-motions suffer more or less extensively in freedom; they may be absolutely null at the lower part of the affected side: where there is any play, the intercostal spaces deepen during inspiration greatly,—or they may do so, independently of action in their own planes, through atmospheric pressure. The vocal fremitus is weakened or annulled; the width of the side increased to the eye and to measure; the interspaces, widened and even bulged out inferiorly, may be natural superiorly.

901. The percussion-sound falls in pitch, increases in mass of tone [Type 2 : 197], eventually becoming of true tympanitic quality, and retaining this until the accumulation of air becomes excessive [200]. Local pneumothorax, in front of the trachea and large brouchi, may give an amphoric note; so too, however, may general pneumothorax: at least I have ascertained this, where a very small quantity, only, of fluid co-existed.

902. If the quantity of air be moderate, the respiration is of distant, weak type,—if considerable, suppressed, except close to the spine. The conditions of vocal resonance vary: there may be mere nullity of sound; in some cases the resonance is loud and diffused; and possibly it may be sometimes accompanied with metallic echo. The heart's sounds are, as a rule, obscurely transmitted through the air in the chest; but sometimes (as in the analogous case of air-distended stomach) they are intensified and acquire a metallic quality or ring.

903. The mediastinum, heart, and diaphragm are more or less displaced, and the grave or tympanitic percussion-note may extend considerably beyond the middle line.

904. (b) *Simple hydropneumothorax.*—In these cases the signs are a combination of those of pleuritic effusion and of pneumo-

thorax, the former at the lower, the latter at the upper, part of the side.

905. (c) *Fistulous hydropneumothorax*.—When hydropneumothorax co-exists, as is the rule, with perforation of the lung, fluctuation may be felt both by patient and observer, when the chest is abruptly shaken; peripheric fluctuation exists to its maximum amount;* while Hippocratic succussion-sound, with its metallic ringing splash, readily produced one day, may be absent the next: these three signs may exist, although closure of the perforation has taken place.

906. By percussion the deficient resonance dependent on fluid, and the tympanitic quality produced by air, are found, according to the posture of patients, the former inferiorly, the latter superiorly: but the exact sites of both may be variously changed (unless adhesion,† which is rare in well marked cases, interfere) by altering that posture. Between the areas of tympanitic air-resonance and the dull sound of the fluid a narrow space may be found, furnishing an amphoric note,‡ and also a quivering sensation to the fingers, produced obviously by the momentary displacement of the fluid.

907. The respiration weak, distant, or amphoric, may or may not be accompanied with metallic echo or tinkle; the cough and vocal resonance are similarly echoed: the amphoric quality is most obvious, when auscultation is performed close to the perforated spot. But it must not be forgotten, that the respiration-sounds in some cases where the fistula is variably open, are amphoric at one time, and simply weak and distant or actually suppressed at another. Under these circumstances a peculiar inspiratory sibilus is sometimes heard all over the side, and probably depends on escape of air through the chink in the lung.§

908. The heart's sounds, commonly weakened in their passage across the distended pleura, may be intensified by unison-resonance [462], or followed by metallic echo.

909. The various displacements of organs are carried to the extremest possible limit.

910. *Diagnosis*.—The distinctive marks between pneumothorax and highly marked emphysema are considered with the history of the latter disease.

911. *Prognosis*.—The prognosis of perforative pneumothorax is

* Plimpton's case, loc. cit.

† Singularly arranged in Healy, U. C. H., Females, loc. cit.

‡ Plimpton's case.

§ Ibid.

very difficult to establish at the time of its occurrence. It may prove fatal within twelve hours,* a few days, or a week or two,—or the patient may completely recover from its immediate effects. The clue to these differences is by no means easily found; for, although in some cases the slight amount of previous pleural adhesions (a state permitting great accumulation of air) and considerable advancement, locally and constitutionally, of the disease causing perforation, appear to account plausibly for a rapidly fatal issue, death has been of tardy occurrence in some cases of the sort, and *per contra*, has rapidly ensued, where the attendant circumstances were precisely the converse. Nor does an examination of the state of the non-perforated lung aid very materially in settling the question: for, if, while in the main tolerably healthy, peripheral tubercles even to a small amount are lodged immediately beneath its pleura, that membrane may give way at any moment, and immediate death ensue; whereas experience proves that in some cases of prolongation of life after the perforation of one lung, the other has been the seat of numerous deep-seated cavities.

912. When the occurrence is not fatal at once, the perforation may either undergo closure by lymph, or remain pervious. I have seen two cases of the former kind, in which all signs of air and fluid in the pleura had disappeared in the course of two months after the perforation: here the cure was absolute. Even when the opening remains pervious, the compound disease is not necessarily fatal. Laennec refers to a phthisical case where the signs of fistulous hydropneumothorax continued at the end of six years; and instances have now been collected in some numbers in this country and abroad, positively proving that not only may life be prolonged, but excellent health enjoyed, while succussion-sound is well audible in the side.

913. In some recorded cases of perforation happening in the course of active phthisis, after the first sufferings of the accident had passed away, it has certainly appeared, though the signs of hydropneumothorax remained, that the phthisical symptoms themselves underwent improvement. The cases referred to in the last paragraph are instances in point. Dr. Stokes plausibly refers the disappearances of hectic fever and its attendants under the circumstances to the collapse of and pressure on the lung, obliterating its vessels, and interfering with local processes of irritation.

* The most rapidly fatal case (in four hours) I have seen was that of Imbach, U. C. H., loc. cit.

Were this fortunate course that usually run by perforative pneumothorax, instead of its being an infinitely rare one, there might be found in the fact some warranty for the proposal, that has actually been made, to treat phthisis by producing artificial pneumothorax.

In Laennec's case of bilateral pneumothorax, where singularly enough, the lungs contained only a small number of milinary tubercles, life was prolonged for three days, after the first symptoms; but there is no particle of evidence as to the time of occurrence of the second perforation.*

914. *Treatment.*—The treatment of perforative tuberculous pneumothorax is palliative. In cases of severe suffering, if the patient be seen immediately, or shortly after, the pleura has given way, while his agony, both of pain and dyspnoea, exists in all the intenseness of novelty, bleeding suggests itself as a means of relief. The quantity of oxygenating surface has been suddenly reduced, and the sudden disparity between that surface and the mass of the blood might, or must, I think, be somewhat lessened by diminishing the quantity of the latter. Whether this be the explanation or not, venesection does give very notable relief, and renders subsequent inflammation of the pleura less violent. It should then be had recourse to, where the patient's strength has not been materially impaired by the previous disease. In doubtful cases, moderate cupping of the side may be substituted,—or, if the effects of even this mode of depletion be feared, general dry cupping of the chest. It is singular what relief, both of pain and dyspnoea, is sometimes afforded by the latter process. Repeated flying blisters to the side are also most valuable agents. The bowels must be kept moderately open, perspirable action of the skin promoted, the strength maintained by nutritious animal jellies and broths, or by meat, if the patient's digestive powers be not enfeebled: while inflammatory symptoms are controlled, as they arise.

915. Various anti-spasmodics prove useful in mitigating the dyspnoea,—lobelia inflata, cannabis indica, belladonna, stramonium, aconite, and above all, opium. I have seen musk, in doses of five grains, afford great relief. Full doses of hydrate of chloral deserve trial; and immense comfort may be attained by repeated inhalation of very small quantities of chloroform.

* Dr. Carson's proposal to kill cattle for market by opening both sides of the thorax is well known. On the other hand, Cayrolles (Anat. Path., *L'avis aux* HÉRÉSIS) dr. LAMONNIE says he has performed the experiment without noting even any particular dyspnoea on the part of the animal—he probably did not secure freedom of communication through the openings.

916. *Thoracentesis*.—In tuberculous pneumothorax, paracentesis can only, as a rule, be regarded as palliative, and, what is worse, temporarily palliative. Still, as the operation does not obviously place the patient in any way in a worse position than he had already fallen into, and as it may give new existence for a time, there can be no objection to its employment, and to its repetition, when physical signs show that the mediastinum and the non-affected lung are seriously encroached upon. I have had it performed twice under such circumstances, and with the effect apparently of prolonging life. In eight phthisical perforative cases, collected by M. Saussier, one terminated by recovery after the operation. Ioduretted injection of the sac deserves trial.

917. It is difficult to lay down a rule for other varieties of perforative pneumothorax; recorded cases are deficient in detail for our guidance, and to me it appears that where recovery has ensued, it would have occurred without the operation. If pneumothorax were suddenly produced in a fit of violent coughing, as in whooping-cough, and the patient had previously exhibited no evidence of organic disease of the lung, I should hold it advisable, especially if the symptoms were urgent, to puncture the thorax.

In the case of empyema perforating the lung, I should not consider the accomplished fact of perforation an argument in favour of paracentesis.

SECTION VI.—DISPLACEMENTS OF THE LUNG.

I.—DISPLACEMENTS WITHIN THE CHEST.

918. Like the uterus and the intestines, the lung is very subject to undergo displacements of various kinds,—but in this particular more resembling the heart, changed positions of the lung are without grave significance.

919. Displacements of the lung are always, as far as I know, partial,—never affecting the root of the organ in such manner, that its entire mass shall be bodily dislocated in one direction or another.

920. Accumulations of fluid and of gas in the pleura, mediastinal tumors and aneurism, are the chief intra-thoracic causes of displacement. The lung may, besides, be crushed upwards by a variety of abdominal enlargements,—its anterior portion being always displaced more extensively than the posterior.

921. An aneurism of the arch may push the lung downwards

in such manner that the highest point of the organ shall not reach above the second intercostal space.*

II.—PULMONARY HERNIA.

922. Hernia of the lung through the intercostal muscles has been observed as a result of penetrating chest-wounds; as a sequence of fracture of the ribs, the superjacent skin remaining intact; and as an effect of violent coughing and of parturition efforts.†

923. The most remarkable known case of the second kind is that published by Cruveilhier.‡ In the body of a man, cut off by cholera at the age of 77, a mass of lung was found lying between the third and fourth ribs, invested by the serous membrane forming a hernial sac, and covered by normal integuments without intervening pectorales muscles, major or minor; the accident to the ribs had occurred in youth, and the pneumocele been early diagnosed.

924. The detection of a pulmonary hernia will turn upon the presence of a soft swelling on the chest-wall, diminishing in size in inspiration, increasing in expiration, especially if forced, as in coughing,—the ease with which it may be kept in with a pad,—and the absence of grave symptoms. Gentle percussion will probably give a pulmonary note, and respiration-sounds will be audible within and about the area of the prominence.

925. *Diagnosis.*—The only condition which can conceivably be confounded with hernia of the lung is a circumscribed collection of pus under the skin communicating with empyema. This too falls in with inspiration and swells with expiration. The soft yieldingness of lung-substance might be very difficult to distinguish from the fluctuation of pus. Percussion and auscultation, applied not only to the moving part, but to the surrounding region, would remove the difficulty.

SECTION VII.—PULMONARY NEUROSES.

I.—PULMONARY HYPERÆSTHESIA.

926. The pulmonary apparatus is highly endowed with a special sensibility, as proved by the exquisitely painful sensation produced by want of air. Here is one of the chief sources of suffering in all forms of dyspnoea.

* Brader, U. C. H., Females, Clin. Lect., Lancet, vol. i., 1849, p. 117.

† Lacunée (Dis. of Chest) makes brief allusion to a few recorded cases.

‡ Anatomic Pathol., 21ème Livraison.

927. On the other hand the parenchyma of the lung is not only, under ordinary circumstances, feebly provided with common sensibility, but even in the state of inflammation is very rarely the seat of pain, at least of pain demonstrably referrible to itself. Still, pain has occasionally been noticed in central pneumonia, where the pleura had wholly escaped; and various anomalous, and more or less painful, sensations felt by phthisical patients, deeply within the chest, apparently originate within the pulmonary texture. In point of fact, these pains may form the earliest local indications of tuberculous deposit,—appearing in some rare instances at a time when the ordinary physical signs remain either wholly or in great measure absent. Certain morbid processes in the parenchyma appear then to excite well-marked tactile sensibility in the terminal filaments of the pulmonary nerves.

928. It seems impossible also to evade admitting, that in certain cases of intra-thoracic pain, occurring in persons free from organic disease, the pulmonary nerves are the seat of actual neuralgia. Such pains, deeply felt within the chest, and shooting in the direction of the pulmonary branches of the vagi and sympathetic, may exist independently of any other deviation from health, not only local but general,—the absence of gastrodynia and intercostal neuralgia especially being demonstrable.

929. The only physical sign I have ever succeeded in connecting with these painful sensations, and this only in cases of phthisis, is jerking rhythm of the respiration. The quality of the breathing-sounds also may probably be roughened through the reflex influence of such sensations in phthisical cases: but neither intensity, nor any other attribute of respiration, is necessarily affected. in even the severer examples of neuralgia.

930. *Treatment.*—Morbid phthisical intra-pulmonary sensations are either greatly relieved or altogether removed by counter-irritation, and emollient and anodyne inhalation. They are not so directly, as might be expected, modified by anodynes taken internally.

Genuine neuralgic pains within the lungs are occasionally found amenable to iron, quinine, arsenic, and remedies applicable to neuralgia generally; but, as a rule, they are obstinate.

II.—NERVOUS DYSPNOEA.

931. I mean by nervous dyspnoea painful respiration, characterised subjectively by distressing want of breath, though air freely enters the air-passages,—while organic diseases of the lungs,

heart and great vessels, spasm of the bronchia and alterations of the blood (the causes of the ordinary forms of dyspnœa), are demonstrably absent. Limited to females, as far as I have seen, this form of dyspnœa may or may not be accompanied with hysteria.

932. The strong probabilities are, that this peculiar morbid state of the respiratory function originates in perverted innervation—genuine paræsthesia—of the pneumogastric nerves. But so long as the physiological control of those nerves over respiration continues imperfectly understood, caution is requisite in the interpretation of the varieties of dynamic dyspnœa.*

933. It would seem certain that, while the normal experimental result of irritation of the vagi is an act of inspiration,† there are occasionally disturbing conditions at work, which totally alter the effect of such irritation, and convert it into one of expiration.‡ Herein may lie a clue to the comprehension of many of the anomalies of dyspnœa.

934. In nervous dyspnœa the respiration is frequent in excess; the respiration-sounds loud, exaggerated, somewhat harsh, are not seriously altered in quality.

935. The gastric branches of the vagus may suffer as well as the pulmonary in cases of this class; their implication is indicated by uneasy sensations at the epigastrium and excessive or perverted appetite. It seems probable, too, that a saccharine state of the urine may follow:§ the dyspnœa then secondarily becomes, in part, of hæmic mechanism.

936. This form of dyspnœa may temporarily occur in the course of organic diseases of the lungs ||

III.—NERVOUS APNŒA, OR DYNAMIC INFREQUENT BREATHING.

937. The singular infrequency of respiration in chorea may be used as an argument, tending, with others, to localise the perverted dynamism of that disease in the emotional and respiratory-centre of the encephalon.¶

* The amount of experimental labour of the most admirable kind, bestowed on the physiology of the vagus from the day of Head downwards, has been immense; yet the results are often so deplorably discordant, that the clinical student of the whole is often disposed to give up the matter as inherently beyond the power of elucidation. The discovery of the "inhibiting influence" of nerves, it is true, explains many seemingly contradictory results.

† Griesbair, Brit. and For. Med. Chir. Rev., vol. xvi. p. 500.

‡ Experiments of Eckhard, Budge, Aubert, and Ischischwitz, quoted by Griesbair, loc. cit.

§ Vide Shearman on "Neurosis of the Vagus," Med. Times, 1856.

|| Jones, U. C. H., Females, vol. xi. p. 271. Here the nervous dyspnœa was only of temporary duration in the course of phthisis.

¶ Author's Clin. Lectures, Lancet, January, 1849, p. 86.

938. But there exist, besides, some cases, marked by infrequency and other peculiarities of the breathing-act, which seem clearly dependent on defective nervous stimulation,—in a word, upon special anaesthesia of the vagus or medulla oblongata,* I refer to cases where the ordinary indications of hysteria are wanting; and in point of fact, as is familiarly known, hysterical breathing is unduly frequent, not perversely infrequent.

939. In this singular condition the respirations are rhythmically infrequent, numbering sometimes only six in the minute: the breathing-sounds moderately exaggerated, but of good quality. The normal subjective sense of the necessity of breathing seems deficient; and, in some instances at least, voluntary effort at full inspiration scarcely produces the slightest ingress of tidal air. The state is a perfectly different one from the gradually rising and falling apnoea observed in fatty and certain other diseases of the heart, gravely impairing the contractile power of that organ.

IV.—REFLEX COUGH.

940. Before the days of Laennec "stomach cough" played a very important part in popular, and even in professional, nosology. The discovery of physical diagnosis by proving that the lungs were habitually diseased in cases that, to our forefathers, would have inevitably figured as examples of sympathetic cough, has led to a reaction which, undoubtedly, carries men of the present day too far in the opposite direction of rather contemptuous disbelief.

941. For reflex cough is a reality.† Distant irritations in various parts may maintain distressing cough, throwing into the shade their local and direct annoyances, in a state of permanence or intermittence, until they have been themselves removed.

942. Various intestinal irritations (worms, fecal tumors, hemorrhoids); gastric irritations and neuroses; perverted states of cardiac action; utero-ovarian irritations and hysteria are some of the most striking instances in point. The cough in typhoid fever seems to be, before it becomes bronchitic, of reflex mechanism.

943. Now in all these cases the cough is typified by that occurring in certain cases of elongated uvula: the distance of the primary irritation from the lung makes the only difference.

* Valentin (*Die Einflüsse der Vaguslähmung*, &c., 1857) found that section of both vagi in the neck of a rabbit lessened the frequency of respiration by about seven-tenths.

† The actual mechanism of pulmonary, as of all other kinds of cough, is of course reflex; but the practical import of the word, as used in the text, will not for this reason be misunderstood.

944. Whatever be the seat or nature of the primary irritation, *idiosyncrasy* is concerned in the particular implication of the breathing apparatus. Thus I have known the trilling irritation of a lumbric worm keep up reflex cough for several weeks; while in a case of fecal tumor, in a middle-aged female, producing reflex clonic and tonic spasms so violent, that in one of them she broke the neck of the femur, there was not a particle of cough.

945. Reflex cough is habitually dry, or nearly so; generally speaking violent; rather laryngeal in character than pulmonary; often accompanied with imperfect, sometimes with perfect, laryngismus: it varies greatly in intensity from time to time; runs a persistent or intermittent course; is scarcely at all, or not at all, mitigated by remedies directed to the chest, and yields to those acting effectually on the primary irritation.

946. *Diagnosis*.—But the conclusion, that a given cough is purely or essentially reflex, can never be fairly arrived at, unless we are able to exclude, as possible causes, textural changes in some part of the breathing apparatus. Now this, it needs hardly to be said, is in some cases a matter of intense difficulty. The longer a given cough holds on without positive physical chest-signs being discoverable, the stronger the probability of reflex mechanism; but a very limited deposit of tubercle, seated so as to evade detection by physical examination, may be the real cause of a cough, that seems due to a distant and readily demonstrable irritation. Time alone can in such cases settle the question,—and caution in *prognosis* is absolutely necessary.

SECTION VIII DISEASES OF THE PARENCHYMA.

I.—PRIMARY MORBID CHANGES.

947. A given portion of the lung may be brought within a smaller area, than that it naturally occupies even in extreme expiration, by various causes depriving it, especially of its air, to a less degree of its blood: even the *persistent* air [122] may thus be removed. The implicated tissue is, in consequence, *condensed*.

948. Or, conversely, the proportion of air within the cells may be increased, and those cells distended; the involved tissue, taken as a mass, is consequently *rarefied*.

949. Again, the quantity of air may remain stationary, or nearly so, while the proportion of tissue within a given area increases or diminishes; hence either *hypertrophy* or *atrophy* of parenchyma.

A.—CONDENSATION OF THE LUNG.

950. *Anatomical Characters*.—Simple condensation may affect an entire lung, one lobe, irregular ill-defined portions of a lobe, or sharply-defined lobules, either separate from each other or in contiguous association.

951. Condensed parenchyma is tough, leathery, fleshy to the feel and look (hence Laennec's term, *carnification*); does not tear or break readily under pressure; sinks rapidly in water; varies in colour, according to the quantity and condition of the blood in its vessels, from greyish to dull brown, violet, or purple; is non-crepitant; contains little or no fluid or froth; unless as a pure accident, encloses no exudation-matter; occupies less space than in the normal state, and is consequently depressed on the surface below surrounding parts; gives a plane smooth surface on section; and (unless under certain exceptional circumstances) may, with greater or less facility, be distended with air by insufflation from the communicating bronchi, when it becomes healthily coloured and spongy.*

952. Condensation of tissue is invariably the result of morbid influences beyond the part actually condensed, and is consequently an indirect, not a direct, evidence of disease. But if the condensation be maintained for any long period, the nutrition of the actual part itself undergoes impairment,—atrophy ensues; the bronchial surfaces may also become coherent. To other morbid processes condensed tissue is little prone; the imperfect supply of blood tends to protect it from *sequential* inflammation, serous infiltration, and deposition of new products. But collapsed parts may be the seat of *antecedent* congestion and its results.

953. *Causes and Mechanism*.—Condensation of tissue may result from the following main causes: (a) *pressure* on the pleural surface of the lung; (b) *non-expansion* of cells; (c) *collapse* of cells.

954. (2) The typical conditions of diffuse condensation are best seen in lung pressed upon by fluid or by gas in the pleural sac. To a less degree the contracting action of exudation matter, throwing the subjacent lung-substance into wrinkles more or less deep,

* To Bailly and Legendre (*Archives Générales*, 1844) we are indebted for the valuable idea of insufflating lung, as a test between solidity from collapse and from inflammation. It must not be forgotten, however, that the bulk of a hepatized spot may occasionally, unless the density be very marked, be slightly increased by insufflation; while on the other hand, in undoubted collapse, it is sometimes impossible to distend the part to its normal size.

condenses the intervening tissue. And if chance have deposited a ring of exudation round a portion of lung, the enclosed texture may be rendered completely airless.

955. (*b*) Non-expansion of cells, originally described by Jürg, under the title of "*Atelectasis*" of the lungs,* is a congenital defect principally found in infants of low vital power, in whom the fetal heart-openings show little or no disposition to close, and respiration is from the first attended with difficulty. The condensation here affects the lobular form or arrangement, and especially occupies the anterior edges and posterior bases.

956. (*c*) In contradistinction to this congenital state stands acquired collapse, which may be limited to some portions of a lobule, or involve either separate lobules or irregular portions of lung.†

957. Acquired collapse may, in almost all cases, be traced to influences directly obstructing the movement of air in the communicating tubes; the superficial area of the collapse being directly, and the amount of the collapse inversely, as the calibre of the obstructed portion of the air-passages. The diseases in which such collapse has actually been met with, may be grouped in the following manner:—

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|--------|--|
| | { Chronic enlargement of the tonsils. |
| A. . . | { Permanent narrowing of the glottis. |
| | { Encroachment of tumours, &c., on the upper air-passages. |
| B. . . | { Spasmodic asthma. |
| | { Bronchitis. |
| C. . . | { Whooping cough. |
| D. . . | { Narrowing and obliteration of bronchi. |
| | { Pressure on a main or large-sized bronchus by tumor. |
| E. . . | { Paralysis of the chest-wall. |
| F. . . | { Typhoid fever. |

958. The special mechanism in each of these classes requires to be briefly surveyed.

959. *Class A.*—The mechanism of collapse in these cases has already been explained [54]. Here the collapse affects the inferior parts of the lungs, equally implicates both organs, involves a moderately extensive surface, and, as far as I know, never reaches any very marked amount.

960. *Class B.*—In spasmodic asthma, where the fact of collapse, coincident with the paroxysm, may be occasionally proved, espe-

* *brechts*, "imperfect;" *ektasis*, "expansion."

† An elaborate attempt has been made by Fuchs (*Die Bronchitis der Kinder*, 1849) to show that the anatomical characters of congenital non-expansion and acquired collapse are variously different, but the alleged differences are too slight to require notice in a practical work.

cially at the bases, by changes of percussion-sound (slight loss of resonance and rise of pitch), the mechanism is fundamentally the same as in Class A, but the obstruction dynamic instead of statical. Spasm prevents the entry of air in inspiration to replace that lost in expiration. Where bronchitis co-exists, the influence of glutinous secretion is, probably, felt as in the next class of cases.

961. *Class C.*—The experiments of Mendelssohn and Traube have shown, that artificial obstruction, produced by forcing foreign bodies as far as possible into the bronchial tubes of animals, produces collapse of the structure in direct connection with those tubes, and emphysematous distension of adjacent and distant parts. It seems fair to conclude, that in bronchitis viscid packets of secretion, which expectoration fails to dislodge, play an analogous part. But why, and how, does collapse ensue on such obstruction; the conjecture of Fuchs, that the air imprisoned beyond the obstruction is absorbed into the blood-vessels, is obviously unsatisfactory. Dr. Gairdner* with much greater plausibility, supposes that plugs of secretion, falling back during inspiration on the next subdivision of the bronchial tube, occlude it in the manner of a ball-valve acting on the orifice of a syringe. The consequence must be, that at every expiration a portion of air is expelled, which is not restored in inspiration, partly owing to the comparative weakness of the inspiratory force, and partly to the valvular action of the plug.

962. In hooping cough collapse depends at once on the perverted state of respiration, which allows of almost complete emptying of the lungs of air, and consequent falling in of the chest-wall,—on obstruction by accumulated secretion in the tubes,—and, lastly, on general debility.

963. In Classes D and E, the mechanism of collapse is a combination of those already described.

964. *Class F.*—In 'Typhoid' fever considerable portions of lung are sometimes found in a state of carnification.† That general debility favours the occurrence of pulmonary collapse cannot be doubted; but whether, unaided, it is capable of thus condensing the lung, is certainly unestablished. And yet, I do not know on what other principle typhoid condensation, when pure, is to be explained,—all evidence of bronchitic obstruction being

* On Bronchitis, p. 32, 1850.

† Louis found the large proportion of 19 in 46 fatal cases

deficient. In such cases firm collapse has often been confounded with true hepatisation.

965. Such is an outline of the physical characters and conditions of *acquired* pulmonary condensation; in its practical aspects it is considered with the diseases of which it forms a more or less constant part (*rude* BRONCHITIS, HOOPING COUGH, NARROWING OF THE BRONCHI, MEDIASTINAL TUMOUR). The *congenital* form, atelectasis, requires separate description.

ATELECTASIS OF THE LUNGS.

966. *Symptoms.*—The respiration and connected acts are feebly performed,—the infant's cry wants force, the mouth grasps the nipple imperfectly, and the act of sucking is difficult or impossible. Slight cough sometimes exists.

967. The tissues are ill nourished, and the temperature of the surface low,—obviously because food, both calorific and plastic, is sparingly taken; the skin pallid and slightly livid. Drowsiness accompanied occasionally by convulsions, chiefly excited by abrupt movements, and attended with extreme dyspnoea, indicates suffering of the nervous centres.

968. *Physical Signs.*—Deficient or perverted chest-movements, the base sinking in with inspiration,—some want of resonance under percussion, if the atelectasis be on a large scale,—feeble fremitus with the cry,—marked weakness of respiration, with occasionally a little dry rhonchus, constitute the physical signs.

969. *Course and Termination.*—Atelectasis generally destroys life (which may be said never to have been thoroughly developed) in a few days. Existence, however, may certainly be prolonged for some weeks; complete recovery, with expansion of the lobules affected, is possible; but whether, and how long, the lobules remaining unexpanded, life may be prolonged, seems an unsettled point. I have seen an infant nine months old, in whom, while physical signs and symptoms such as those above-mentioned clearly existed, the history left no doubt as to their congenital origin.

970. *Diagnosis.*—In the case referred to, the circumstances which led me to venture on the diagnosis of atelectasis, rather than of consolidation by chronic pneumonia or tubercle, were these: the absence of pyrexia, the coolness of the surface, the difficulty in taking the breast, the drowsiness of the infant, the slight dulness under percussion at the base (there was, however, some want of tone under the clavicle also), the absence of notable rhonchus, and

of bronchial quality in the markedly weak breathing. But I saw the child once only, and know nothing of its subsequent career.

971. *Treatment*.—The immediate effect of non-expansion being failure of calorific power, and an imperfect state of hæmatosis, the indications of treatment are plain enough.

972. Warm clothing, and high temperature of the surrounding air, dry friction of the skin, the warm bath followed by inunction of oil over the entire surface, with the internal use of cod-liver oil, and, in minute doses, of phosphate of iron, will probably best fulfil these indications. Paroxysms of dyspnoea may be relieved by chloric æther. This, at least, seems the fitting kind of management after the first few weeks of extra-uterine life have been struggled through: for the case of the actually new-born infant, I must refer the reader to works on the diseases of that period of life.

R.—RAREFACTION OF THE LUNG, OR "VESICULAR" EMPHYSEMA.

973. *Anatomical Characters*.—The disease, termed "vesicular" emphysema by its original describer, Laennec, seems essentially characterised, anatomically, by enlarged capacity of the air-cells. But with this state of distension of the vesicles is associated obliteration, more or less extensive, or actual destruction of the capillary rete of their walls, as likewise atrophy of the proper substance of those walls.

974. In emphysema of acute origin, distension of cells is the primary phenomenon; in the chronic disease, atrophous degeneration of the walls of the cells in all probability leads the way in a large proportion of cases.

975. Occasionally oil, as first pointed out by Mr. Rainey, is discoverable in the walls of the alveoli; but it is not constant, and when present, its relationship, of cause or of effect, to the existing atrophy is uncertain, though in all probability its deposition is a sequential phenomenon.

976. Rarefaction, distension, and loss of elasticity are the most striking *physical* characters, practically considered, of emphysematous lungs; with these are linked the symptoms and the signs of the disease. General distension is shown by the downward encroachment of the organs; by their overlapping each other in front at, and above, the level of the second costal cartilages; by their bearing on their pleural surface more or less deep impressions of the ribs;* and by the encroachment of the left lung on the

* Skinner, U. C. H., Males, vol. ix. p. 97

superficial cardiac region. Instead of the natural area of that region, we may have one the shape of a narrow isosceles triangle, the base measuring one third of an inch, the two equal sides about two inches.* Local distension, again, is exhibited in irregular lobulated elevations of the surface by so-called sub-pleural sacculi:—sacculi formed by enormous distension of some air-cells and total destruction of others: they are in truth *air-cavities* beneath the pleura, or within the area of the lung.

977. *Seat*.—Emphysema affects one or both lungs, and the entire, or, as is much more common, a part only of each organ. The upper division of the right and the lower of the left seem to suffer most frequently.† The disease may be limited to some scattered vesicles, affect entire lobules or even lobes: in the latter case the interlobular connective tissue disappears.‡ The surface of the organ suffers most;§ the entire substance being rarely affected, though deep-seated islets of the disease are not uncommon. The anterior edges seem particularly prone to emphysema; the sub-pleural sacculi, however, are chiefly met with at the posterior bases and mediastinal surfaces.

978. *Alliances*.—The bronchi, commonly the seat of chronic inflammation, are sometimes dilated,—but not with sufficient frequency to suggest a relationship of cause and effect. Pleuritic adhesions are scarcely more common, pulmonary tubercle less common,|| than in persons of the same age cut off by all varieties of disease indiscriminately. Not only, then, is emphysema not a cause of tuberculisation, but the two diseases seem to a certain extent indisposed to alliance: they are not incompatible, it appears to me, on account of their being attended by antagonistic crases of the blood, as has been suggested by Rokitsansky and others; but simply seldom associated, because they are essentially diseases of different periods of life. The two affections are, in truth, sometimes found in activity in the same individual,—tubercle forming and softening, although the so-called venosity of the blood,¶ or cyanæmia, is carried to the highest point. I believe, however, that as emphysema entails obliteration and destruction of minute vessels, it must within certain limits prevent the deposition of

* Skinner, V. C. H., *Males*, vol. ix. p. 97.

† Louis, *Mém. de la Soc. Méd. d'Observation*, t. i.

‡ Lombard, *de l'Emphyseme pulmonaire*, p. 3.

§ Anatomists teach that the vesicles are normally larger (the extreme diameter being $\frac{1}{16}$ and $\frac{1}{8}$ of an inch) on the surface than in the interior, and largest at the thin edges of the lung.

|| Louis, *loc. cit.*

¶ Just as in cases of genuine cyanosis, the lungs sometimes grow tuberculous.

tubercle, as of any other morbid product: the rarity of pneumonia in highly emphysematous patients is indubitable. Local tuberculation may, on the other hand, lead to the distension of air-cells, in a manner to be by-and-by considered [984]. Interlobular emphysema, as also mediastinal and sub-cutaneous infiltration of air, are very rare, though not actually unknown, sequences of the vesicular disease. A sub-pleural air-sacculus has been known to give way and produce pneumothorax.

Emphysema tends, in the course of years, to produce dilated hypertrophy of the right heart; and maintains more or less habitual venous congestion within the head—a congestion scarcely, however, demonstrably productive of either hæmorrhage or softening. What part, if any, it may play in generating Bright's disease, seems to me as yet undetermined; and the alleged alliance of the two affections, through the fatty diathesis, is wholly problematical: the extremest degree of emphysema, aided even by dilatation of the heart, is not necessarily accompanied with even a trace of albumen in the urine.*

979. Emphysema may, in its clinical aspects, be a *primary* or *secondary* affection,—and, in the former case, be the result of a *chronic* or an *acute* process.

1.—PRIMARY CHRONIC EMPHYSEMA.

980. *Causes and Mechanism.*—Dr. Jackson, junr., of Boston, U.S., found, that of twenty-eight emphysematous persons, eighteen had either a father, or mother, or both, similarly affected; whereas, of fifty non-emphysematous people, three only sprang from emphysematous parents. Further, fourteen persons, emphysematous from early youth, came all of them of emphysematous stock; whereas, of fourteen, first affected at an advanced period of life, two only were of emphysematous parentage. These facts render it, to say the least, strongly probable that emphysema is much more thoroughly hereditary than phthisis.

981. Vallerix thought emphysema congenital in some instances; but he appears to have scarcely been aware, with what great rapidity distension of the cells may be developed. A few hours of extra-uterine obstructed breathing seem capable of effecting their dilatation.

982. Laennec's chain of causation of emphysema, consists of the following links: chronic catarrh; plugging by secretion of minute

* PARSONS, U. C. H., *Males*, vol. xi. p. 151.

bronchial ramifications; consequent difficulty in the movement of air through these: inspiration being a more powerful act than expiration, conveys air inwards beyond the obstruction, which the latter fails to reconvey outwards; air, thus accumulating in the cells, distends them, more especially as it is itself expanded by the high temperature of the lung around. The foundation of the disease is consequently bronchitis.

983. M. Louis denies this mechanism, because the symptoms of dilated air-cells are not always preceded by catarrh,—because habitual dyspnoea does not undergo permanent increase after attacks of acute catarrh,—and because emphysema exhibits its maximum at the anterior borders of the lungs, while the clinical evidences of bronchitis are commonly most marked at their posterior bases. Laennec, too, erred in supposing normal inspiration a more powerful act than expiration [133, 119].

984. Dr. Williams maintains the catarrhal basis of Laennec; but supposes that, while the air-cells communicating with plugged bronchia escape distension, those adjoining, and possessed of free communication with the trachea, dilate in consequence of the extra work and pressure thrown upon them. This relationship and this localisation are supported by the position occupied by emphysema secondary to adjoining tubercle, as originally insisted on by Carswell.

985. Dr. Gairdner, generalising this latter view, looks on emphysema as “a secondary mechanical lesion, dependent on some condition of the respiratory apparatus leading to partially diminished bulk of the pulmonary tissue, and consequently disturbing the balance of air in inspiration.”*

986. Guided by these and other considerations, we may, I think, adopt the following propositions, as embodying the most reliable doctrine of the mechanism of emphysema.

(a.) The vesicular dilatation may be a primary or a secondary phenomenon,—that is, it may occur independently of any acknowledged form of statical change within the chest, or it may supervene on some actual organic mischief.

(b.) The acute emphysema of infancy occasionally illustrates the former mechanism. I have seen well marked emphysema, vesicular and interlobular, in an infant that survived birth by two hours only,—where no form of bronchitis, pneumonia, or atelectasis existed. But almost immediately after birth extreme difficulty of breathing, probably of cerebral origin, had set in. And it

* On Bronchitis, p. 62, 1850

occurrence except as an attendant on expiration.* And in cases of *slow* evolution the act of cough must produce expiratory distension, and aid the inspiratory process.

987. *Symptoms.*—The essential symptom of chronic emphysema, *per se*, is dyspnoea. Often commencing in early youth, or even infancy, at first slight in amount, and only felt on some unusual exertion, such as running up-stairs, it remains, when once developed, a permanent evil, though subject to great variations in intensity. The patient feels as if his chest were never thoroughly, at least naturally, emptied of its air; and is conscious of an annoying sense of inflation or distension. On the other hand, it is true, many persons labouring under emphysema will affirm that their dyspnoea is only occasional,—that habitually their respiration is perfectly healthy. But I have never known an instance of this kind where the patient was not the victim of a delusion; the truth was, that a moderate amount of dyspnoea had become to him second nature, a state of comfort and health,—and excessive difficulty of breathing alone gave him annoyance. The dyspnoea undergoes increase, from time to time, through bronchial spasm, through abdominal flatulent distension of the stomach and bowels, a loaded state of the portal system, or through intercurrent bronchitis. The former two causes produce sudden paroxysmal attacks, requiring the patient to rush to the open window for air, or pass the night in the sitting posture out of bed; the latter, less violent, are more protracted, in their action. The amount of persistent dyspnoea is generally proportional to the duration of the disease. The paroxysm occasionally induces a fit of palpitation, but not of any severity, unless some cardiac disease co-exist.

988. Cough ranks next in importance, as a general rule, among the symptoms. It may precede, commence with, or follow the first establishment of dyspnoea. But, unless excited by intercurrent and accidental bronchial irritation, it may be wholly wanting; in other words, pure emphysema does not necessarily excite reflex expulsive action. The habitual sputa, when expectoration occurs independently of superadded bronchitis, are frothy, liquid, muco-epithelial or watery, never sanguineous: some patients eject the pearly sputum of Laennec's "dry catarrh" [506].

989. It is matter of doubt whether distension of the air-cells alone, or that of the pleura when pouched superficially, may, independently of other intra-thoracic change, give rise to true pain, as distinguished from the specific distress signifying want of air [927].

* Vide Jenner in Med. Chir. Trans., vol. xl. 1857.

My own observation leads me to disbelieve in the occurrence of acute suffering,—but a sense of uneasy aching oppression may be felt, independently of the interference of bronchitis, behind the sternum.

990. The countenance of emphysematous patients is peculiar: of dusky colour, and anxious melancholy expression, the face is full, out of proportion with the chest and body generally,—a probable result of thickening of its cellular membrane and muscles, as suggested by Dr. Stokes,—the former from repeated venous obstruction, the latter from respiratory effort. The nostrils are thick, and very often the lower lip full, and venously turgid; I have, however, not seen the latter state, carried to extremes, without heart-disease. The muscles of the neck enlarge, and its cellulo-adipose tissue disappears. The patient's gait is stooping; the acromial, interscapular, and lower scapular regions sometimes form an almost horizontal plane.

991. The strength ranges inversely as the dyspnoea; in aggravated cases, bodily exertion becomes an impossibility. The fat and flesh of the body generally and slowly waste,—each attack of bronchitis diminishing the weight *pro tempore*, or permanently. The specific gravity of the frame, as a whole, may fall in consequence of the air-distension of the chest,—so that its buoyancy in water, as shown by improved facility of swimming, increases,—a fact that occasionally astonishes the patient himself not a little, as all the while he grows more and more short-winded. The condition is a minor degree of that observable in pneumo-thorax, which will cause the dead body to float [893].

992. Emphysema is non-pyrexial. The pulse is not accelerated,—far from this, it ranges below the average of health in a considerable number of cases, except when intercurrent bronchitis is present. The respiration also, with the same qualification, is less frequent than in health; in fact, the act is so laboured and prolonged a one, that it cannot be often repeated in the minute. The pulse often strikes the observer by its weakness, as compared with the amount of cardiac impulse. This want of accordance comes of the frequency with which the right heart undergoes enlargement—a consequence of the pulmonary disease,—whereas the left does not thus suffer. I have noticed visibleness, with locomotion, of the radial pulse at one or other or both wrists, independently of aortic regurgitation,—but never more than to a slight amount. The skin is habitually cool and free from moisture; even sub-pyrexial rise of temperature indicates intercurrent disease.

993. No conceivable amount of emphysema, even of both lungs, will necessarily entail the smallest amount of dropsy,—even of oedema of the ankles. If dropsy occur, there is some other morbid state (generally speaking, tricuspid regurgitation) to account for its appearance.

994. The appetite is commonly below par, and the bowels constipated: the want of exercise, enforced by habitual dyspnoea, explains both conditions. Some patients at the time of spasmodic seizure suffer from diarrhoea.

995. The urine, habitually aqueous, may become excessively so, during, and for twelve hours after, paroxysms of dyspnoea; beyond this I do not know that anything can be considered to be established. Whether the pure disease affects the proportions of the solid ingredients seems matter of doubt. Lehmann gives an analysis in one case in which the urea was lowered, the uric and oxalic acids increased,—presumably results of imperfect oxidation: but here there was co-existent bronchitis. If the liver be congested, the urine may assume the hepatic type. Saccharine impregnation, which might be expected on account of the imperfect oxidation in the lungs, has been shown to be absent.*

996. The voice loses tone and strength; sustinment of a note, protracted or loud speaking, become intolerable efforts. These changes depend on the deficiency of tidal air simply: there are no alterations of register, pitch or quality of voice indicating organic changes in the larynx.

997. *Physical signs.*—Inspection discovers bulging of the infra-clavicular, mammary, and central sternal regions, or of the anterior surface, uniformly. General expansion of the chest occurs very rarely; M. Louis observed it only once in ninety-six cases: when it exists, it gives the thorax a globular form.

998. The state of the interspaces in the bulged portions of surface has been matter of dispute. Dr. Stokes has taught that in emphysema, "even after great dilatation of the chest has occurred, we see the intercostal spaces, so far from being obliterated, *deeply marked*;" and that the single malady in which such obliteration really occurs is plenisy in its advanced stages. The conditions essential to its production are theoretically assumed to be *paralysis* of the intercostal muscles and centrifugal pressure, one being as important as the other; this paralysis is presumed to be the result of inflammation extending to the muscular tissue. For the same reason the intercostal spaces will not be obliterated in cases

* Uhle, *Experimenta de Saccharo*, &c. 1862.

of simple hydrothorax, nor in *all* instances of pleuritic effusion: because muscular inflammation and paralysis do not exist at all in the former, and are not *necessarily* present in the latter.

(a.) The question here started is strictly one of observation; and it must be confessed that the published experience of physicians generally does not accord with that of Dr. Stokes in respect of the bulging of emphysema. Both Louis and Woillez are wholly opposed to Dr. Stokes on this point. Both maintain that the intercostal hollows are in this affection either effaced or manifestly less marked than in the natural state; and even point out this implication of the muscular plane of these spaces as one of the distinctive marks of emphysematous prominence.

(b.) It seems, however, possible to reconcile these conflicting opinions. I believe, in point of fact, that in emphysema, the conditions in respect of bulging are of three distinct kinds. *First*, there may be no expansion at all, general or local; *secondly*, there may be bulging of the surface generally, with a natural state of the intercostal spaces; and *thirdly*, there may be bulging with distinct obliteration of the intercostal hollows. The key to these apparent contradictions lies mainly in the anatomy of the disease—in its anatomical varieties, which have in this point of view escaped the consideration of the observers referred to. In the *first case*, I have found the disease, which, in respect of symptoms, may have been very intensely marked, of the *atrophous* kind, with but *slight* distension of the lung; here the physical cause of expansion was altogether wanting. The *second variety* of prominence I have never observed in the infra-clavicular region (when alteration of shape was limited to that region, one of the special seats of such change in emphysema), but have met with it elsewhere in certain cases of almost globular expansion of the thorax in emaciated emphysematous subjects. But in these instances—and doubtless they exist more frequently than they are discovered or suspected—the local prominence, when characterised in the manner now referred to, was in all probability, especially when occurring at the back, a natural conformation, and wholly *independent of the emphysema*. *Thirdly*, when bulging has existed in regions where observation proves it to appertain specially to emphysema, such as the infra-clavicular, I have found the intercostal spaces distinctly prominent, and the disease, if opportunity for *post-mortem* inquiry presented itself, either of the *hypertrophous* kind, or of the atrophous variety, with great distension of the lung and formation of sub-pleural air sacculi,—a distension

which may be looked on as simulative, physically, of local pneumothorax. A woman* came under observation with acute bronchitis, superadded to extensive emphysema, with great lividity of surface, and without valvular disease or notable cardiac dilatation; bulging of both bones and spaces existed in certain parts. Now, as the bronchitis disappeared under treatment, and consequently the general air-distension of the lung diminished, the interspaces became hollow.†

999. Inspiratory expansion-movement falls to a minimum, the lower part of the sternum and adjoining cartilages, in aggravated cases, even sinking inwards during inspiration,—nay, the base of the chest generally may then slightly retract circularly [54]. On the other hand, the elevation-motions are exaggerated,—the whole chest is raised, with the shoulders, as one piece.‡ The duration of the expiratory movement considerably exceeds that of the inspiratory; both acts are laborious,—the expiratory, because the elasticity of the lung is destroyed by the disease,—the inspiratory, because the previous expiration has failed to empty the lungs to the normal amount, and the chest is with difficulty further dilated. The faculty for prolongation of the expiratory act, is probably derived from irritative hypertrophy of the muscular coat of the bronchial tubes:—their expressing power being permanently taxed to the utmost. The respiratory action of the intercostal planes may be completely perverted,—bulging occurring in inspiration; the latero-inferior interspaces may bulge outwards beyond the level of the ribs in expiration.

1000. The condition of vocal fremitus varies; it may fall below, equal, or exceed the average of health.

1001. The semi-circular measurement of one side, or of the whole chest, is increased; in right-handed emphysematous persons, as earliest noticed by Woillez, the excess of width of the right

* Quinland, U. C. H., *Females*, vol. xiv. p. 41.

† The difference of opinion under consideration appears to be very readily explicable in the manner now proposed. What I have stated I believe to be in strict conformity with observation, whereas I am not aware that Dr. Stokes's theory, of inflammation of the intercostal muscles being a necessary condition of their eccentric displacement, rests upon any observed cases, submitted to close anatomical examination. It is not easy to understand, in his theory, why the intercostal muscles should resist eccentric pressure more powerfully than the ribs, and thus, he it noted, equally in frames of every degree of muscular weakness or vigour. It appears to me that there will always be more or less hollow in the intercostal spaces, as has been shown by M. Woillez, so long as the elasticity or concentric force of the lung is not destroyed; that as soon as this change has taken place, as, for example, from the progress of emphysema, pressure sets in and influences the position of the intercostal muscles at least as readily as that of the ribs.

‡ The strain on the extraordinary muscles of respiration is sometimes very great. I have known violent tic of the cleido-mastoids accompany the paroxysm of dyspnoea.

over the left half of the chest inferiorly ranges lower than natural, —showing by inference the greater frequency of emphysema of the lower part of the left lung. The disease may, however, be highly marked without any such increase.

1002. (a) The percussion-sound is essentially of Type II., that is:—mass of tone increased; pitch lowered; quality exaggerated pulmonary, or tympanic. This excess of resonance extends beyond the middle line, if one lung only be affected. The natural tone at the sternal notch, where no lung exists in health, is exchanged for emphysematous resonance; this fact, which depends on the junction of the edges of the lungs taking place higher than natural, in consequence of their distension, is very easily ascertained, both in the living and dead.* Forced expiration has little or no effect in diminishing the amount, or contracting the area, of the morbid resonance.

(b.) In rare instances the percussion-tone is deadened in association with extreme parietal distension,—muffled like that of an overstrained drumhead.

1003. The respiration in emphysema belongs to one or other of two main types: it is either weak; or of raised pitch, and altered quality. When of weak type, the failure may amount to actual suppression in some points; while in others, exaggerated respiration of harsh quality exists. Of the occasional existence of such exaggeration in lung-substance, on the confines of circumscribed emphysema, I have satisfied myself by a considerable number of observations; but, on the whole, it is rare. Respiration of raised pitch, loud, harsh, and uneven, exists, in many cases, immediately over emphysema carried anatomically to the very highest point; the quality is sharply sibilant, and in part it may be constituted by a sibilant rhonchus in the very finest tubes.

1004. The rhythm of the sounds is very variously altered. Inspiration may be deferred; and the two sounds both jerking and clearly divided from each other. The inspiratory sound is comparatively short, the expiratory greatly prolonged: the ratio of the former to the latter sound may be changed from 3:1 to 1:4; in other words, the latter sound made *twelve* times longer in proportion to the former than in health. In such cases of enormous prolongation of expiration, this is rather a fine sibilant rhonchus than true respiratory sound. Rhonchi, bronchial, and dry or moist, are evidences of bronchitis, or of spasm of the tubes: very commonly, when an emphysematous patient seeks advice,

* Dickinson, U. C. H., Males, vol. xvi p. 244.

both bases are the seat of fine bubbling rhonchus. None of these rhonchal sounds owe their existence directly to emphysema: a peculiar dry crackling noise, by some termed a rhonchus, of doubtful mechanism, and rarely heard [341], forms, along with dry grazing friction-sound produced by prominent sub-pleural air-sacculi,* the sole direct rhonchoid sign of the disease.

1005. The vocal resonance varies. It may be normal, null or intensely bronchophonic. When very feeble, this apparently depends on weakness of the laryngeal voice,—itself caused in turn by the imperfect supply of air and laboured process of expiration.

1006. The heart's sounds, as a rule, are feebly transmitted through emphysematous texture [462]. Whether they are ever intensified by unison-resonance, as in some cases of pneumothorax [902], is more than I can say from experience, but it seems quite possible they may be.

1007. Signs of importance are derived from the heart. If one lung only be affected, the heart is pushed slightly to the opposite side; if both are implicated, downwards, and commonly to the right somewhat, inasmuch as the left lung is generally more affected than the right, at the base. The precordial region, filled with distended lung, is bulged forwards, and gives low-pitched, full-toned resonance under percussion; no cardiac impulse may be felt within its area,—that impulse being transferred to the epigastrium. Enlargement of the right chambers, however, plays its part in thus altering the seat of impulse. The jugular veins may be swollen, though the heart is not obviously diseased; but I have never known them pulsatile, without co-existent affection of that organ. Emphysema is sometimes, we have seen, accompanied with visible arterial pulse [992].

1008. *Diagnosis.*—The only affection with which emphysema can be physically confounded is pneumothorax. The distinction is not difficult. In emphysema the percussion is less truly tympanitic than in pneumothorax; the area of morbidly exaggerated resonance less extensive; the side is less dilated; there is more respiration (and, possibly, loud, sibilant, respiration, as we have seen), and such respiration as exists is superficial, instead of being deep-seated and distant, as in pneumothorax. Besides, pneumothorax is unilateral; whereas, if emphysema exist to such a degree as to simulate in regard of percussion-sound the presence of air in the pleura, both lungs prove to be very seriously affected.

* Quinland, U. C. H., Females, vol. xiv. p. 40.

It is true bilateral pneumothorax is not a clinical impossibility [892]; but its infinite rarity and the speed, with which it must prove fatal, will spare the observer the risk of error. Lastly, the symptoms of pneumothorax come on suddenly, and are greatly more urgent than those of emphysema.

1009. *Prognosis*.—Emphysema may last a lifetime prolonged beyond the ordinary span; and never, as far as I know, kills *per se*. But, inasmuch as it gives extra severity to bronchitis, of which it may be looked on as a permanent predisposing cause, and likewise entails dilatation and hypertrophy of the right side, especially, of the heart, the position of an emphysematous patient must practically be considered more or less precarious.

1010. *Treatment*.—The anatomy of emphysema prepares us to fear that its radical cure is impossible; we have no means of causing reproduction of destroyed lung. Experience, unfortunately, goes farther than this, and shows that *permanent* palliation even proves difficult of accomplishment; *temporary* relief is, on the contrary, most readily effected: the fair aim of art is, then, to ascertain, how a state of brief ease may be indefinitely prolonged.

1011. The proofs, that great amelioration is actually produced by treatment, are furnished not only by favourable change in the symptoms and in the patient's feelings, but by alterations in the physical signs: the morbid resonance under percussion may be lessened, the quantum of respiration increased, and the distension of the lung reduced. The latter fact I have shown may be demonstrated by increase in the superficial extent of chest-surface unpaired in its resonance by the subjacent heart,*—in other words, by increase in the area of the heart's superficial dulness. But what organic change in the lung-substance do these alterations in physical signs demonstrate? Not assuredly, that atrophy is gone, but that *distension* is reduced. And the reduction of distension is effected by the removal of bronchitis and the relaxation of spasm.

1012. In nine cases out of ten, when a sufferer from emphysema applies for relief, sub-acute, or more rarely very acute, bronchitis is present. Local bleeding, blistering, and small doses of tartar emetic are the essential agents for its removal; but when emphysema exists to any amount, caution in the employment of depletory measures is essentially called for. The other remedies, spoken of under the head of bronchitis, are not to be forgotten,

* Clin. Lect., Lancet, loc. cit., April, 1849.

however, when the first vigour of the inter-current disease is controlled.

1013. For the habitual chronic bronchitic state, I know of no combination superior to the æthereal tincture of lobelia inflata, with ipecacuanha, oxymel of squills, and compound tincture of benzoin, in ammoniacum mixture.

1014. Fits of dyspnoea are to be relieved by extract of cannabis indica in half-grain to grain doses, or by belladonna and stramonium, either in the form of pill or smoked in cigarettes. Stramonium alone may be used in an ordinary pipe, and may be more safely entrusted to patients than belladonna: it may be smoked until the head begins to ache slightly. Opium, however, must be had recourse to in very severe attacks, and may be given until sensible, but slight, narcotic effects are produced. The camphor cigarettes of Haspail occasionally afford notable relief. A full dose of hydrate of chloral (forty grains) will sometimes put an abrupt end to a paroxysm by putting the patient to sleep at once. Other remedies applicable in the paroxysm are enumerated under the head of SPASMODIC ASTHMA.

1015. Arsenious acid, in some rare instances, seems to lessen the violence of the paroxysms, and render their recurrence less frequent. There can be no objection to its cautious trial in obstinate cases. But I should hesitate to employ the arsenical cigarettes of Trousseau,* — more especially as even the seeming evidence of their special utility is yet a desideratum.

1016. Transmission of the *interrupted* galvanic current from the nucha to the epigastrium will sometimes avert, frequently mitigate and postpone, the paroxysm of dyspnoea.† An emetic will do so also: especially when the attack is connected with a loaded state of stomach. Cajuput oil and other carminatives, with soda, put a term to that caused by flatulent distension. The statements made concerning chloroform-inhalation in the treatment of simple spasmodic asthma [1463] hold true only to a certain extent of asthmatic seizures accompanying emphysema: that is, relief in the paroxysm is here easily obtainable; but, on the other hand, serious and permanent impression on the malady cannot be even hoped for.

I have known the frequency and intensity of seizures lessened by the *continuous* electric current.

* Blotulous paper is saturated with a solution of two to four grammes of arseniate of soda in twenty grammes of distilled water: portions are dried, rolled into cigarettes, and then smoked.

† M. Henley, L' C. H., Males, vol. vi. p. 126, April, 1851.

1017. Strychnia has been recommended for the purpose of improving the tone of the non-striated fibre of the bronchial tubes. I have tried it in a small number of cases, both endermically and by the mouth, in sufficient doses to produce obvious effects on the voluntary muscles, without in the slightest degree modifying the symptoms of the emphysema.

1018. Regularity of habits, moderation in indulgence at table, and the avoidance of efforts of all kinds, and as far as possible of strain in breathing, are essential to the well-being of emphysematous sufferers; and it is obviously, from their forced obedience in regard of these points, that their lives are often (a questionable boon, it may be, as they themselves often emphatically aver) prolonged beyond the average term of existence.

Lehmann, regarding emphysema from the chemical point of view alone, teaches that this class of sufferers are best to be relieved by "practising augmentation or expansion of the chest in respiration, or taking exercise suited to produce this result, while we should forbid the use of spirituous drinks and not prescribe tinctures, which might hinder the necessary excretion of carbonic acid."*

1019. Change of air proves singularly beneficial, or singularly detrimental, according to the nature of the change; but no amount of experience will enable the physician to predict positively what manner of air, soil, elevation, or geological formation will best suit any individual case.

1020. Emphysema being one of the affections in which the effects of the compressed air bath have been most lauded, it may be as well to introduce here a brief description of this agent.

(a.) Upwards of seventy years ago, the Royal Society of Haarlem proposed, as a subject for competition, the influence of condensed air on animal and vegetable life. The queries put by the Society appear to have met with no response. At a later period, Sir John Sinclair suggested, on the ground of experiments which had been made on the lower animals, that individuals in given states of disease, might be made to breathe compressed air with advantage. But to M. Junod we are indebted for the first authentic experiments on the human subject in the state of health.†

* *Physiol. Chemistry*, by Day, vol. iii. p. 353. But does not the distinguished chemist here forget the dynamics of the disease and its status also, for is not the chest too much expanded already as part and parcel of the complaint? And is it wise to agitate the results of cautious clinical experience? Or is it philosophical in the present merely tentative condition of vital chemistry even when a Lehmann and a Löwig are the workers to revive the attempts that, in the hands of the electro-chemists of by gone days, came to such utter grief?

† *Seances de l'Acad. des Sciences*, Août, 1835.

These experiments seem, however, to have been rudely conceived and executed,—whence, probably, the decisively unfavourable Report of Magendie on the subject, declaring that the treatment by compressed air was inapplicable to the human subject.*

(b.) Meanwhile M. Tabarié appears to have been conducting a series of most careful trials; and to have had the merit of establishing the feasibility of the system. Under his direction M. Bertin, at Montpellier, as also MM. Pravaz,† Millet, and others of Lyons, have largely applied condensed air in the treatment of a variety of affections.

(c.) The apparatuses invented by M. Tabarié, are hollow spheroids of wrought iron, of various sizes, to hold one, two, or ten or a dozen persons at once. The air is pumped in by steam-engines, —and a contrivance adapted by which that vitiated by respiration is removed. The least pressure employed medically is about half an atmosphere, the greatest two-thirds of an atmosphere. Each sitting lasts two hours; the first half hour is occupied in increasing, the last in lowering the pressure; an hour is consequently passed under the full excess of pressure. The mean number of baths required for various chronic diseases is said to vary from thirty to forty.

(d.) Physiologically these baths slacken the pulse and respiration as a rule; drive the blood from the surface; excite the appetite; and throw into the system an excess of oxygen. The venous circulation is said to be rendered more active, and secretion and absorption promoted.

Singularly enough, some of the effects are precisely the same as those produced by diminished atmospheric pressure,—difficulty of utterance, feebleness of voice, inability to whistle, without the least disposition to cough; sense of pressure on the membrana tympani; and much thirst, without notable excitement of the urinary organs.

(e.) Among the pulmonary affections said to be benefited by the compressed air bath are emphysema, with or without distinct paroxysmal asthmatic seizures, and acute and chronic bronchitis. That a sense of comfort,—sometimes great comfort,—is experienced in the bath by asthmatic sufferers, I hold on their own indubitable testimony. And, further, I have known very prolonged relief obtained in asthma associated with emphysema; but it has

* Bertin, "Du Bain d'Air Comprimé," p. 7—a logically and conscientiously written volume.

† *Emplot Medical de l'Air Comprimé*, 1850. See, also, "Compressed Air as a Therapeutic Agent," by A. Simpson, M.D., 1857.

not occurred to me to meet with any case in which actual cure, even of purely dynamic asthma, has clearly followed the very fullest employment of the system.

II.—ACUTE VESICULAR EMPHYSEMA.

1021. Pulmonary emphysema is unquestionably, in the main, a disease of the chronic class. M. Louis, registering the fact as singular, records a case where, at least symptomatically, it grew up in twenty-nine days.

1022. There is no doubt, however, of the actually acute development of emphysema under a variety of circumstances. I have seen it, accompanied with interlobular emphysema, highly developed in an infant born without dyspnoea, and dying two hours after with obstructed breathing [986]. The freedom of respiration at birth satisfactorily disposes of the idea of the disease having, in this instance, been congenital.

1023. The lungs of persons, dying in the algide stage of cholera, occasionally present emphysema in addition to general pulmonary collapse,—the former, in infinite probability, the result of the latter, and occurring within the true algide period.

1024. Of the less rapid, but still acute, development of emphysema in bronchitis, influenza, whooping cough, and acute phthisis, enough is said with the descriptions of those diseases.

1025. In the very acute forms of the disease the anatomical changes do not appear to be carried beyond the stage of dilatation of the cells: how soon atrophy may set in is yet undetermined.

1026. May cells thus acutely dilated be restored in course of time to their natural condition? I am led to surmise that such may be the fact, from the extreme rarity with which the origin of chronic emphysema can be satisfactorily traced to an acute pulmonary attack.

III.—VESICULAR EMPHYSEMA SEQUENTIAL TO ORGANIC DISEASE.

1027. Emphysema, either affecting vesicles singly or in groups, or involving the entire of a lobule, tends to spring up, on the principle of obstruction already explained [986], in the neighbourhood of portions of lung disabled by tubercle, and other forms of organic disease.

1028. Such development of emphysema modifies the pre-existing physical signs of tuberculisation. The percussion-note falls in pitch, increases in mass of tone, and becomes more pulmonary in quality; but the respiration-sounds grow yet weaker than

before, or lose in some measure their previous bronchial quality. These changes might easily induce the erroneous belief, that retrogression of the tuberculising process, even absorption of the deposit, was occurring.

1020. But, if the emphysemæ be carried to any amount, increased dyspnœa, lividity of the face, and coldness of the tips of the fingers, will disclose the true cause of the alteration in the physical signs.

1030. It seems impossible to avoid admitting that the secondary development of local emphysema, causing pressure on, obliteration and wasting of, the capillary rete, must act as a barrier to the further direct deposition of tubercle, within the actual area of patches of dilated vesicles. But this local interference with exudation from the blood-vessels, it need scarcely be added, does not even insure cessation of the tuberculising process in other parts of the lungs, still less does it involve such diathetic change as shall entail the practical cure of phthisis. Even the spontaneous general development of emphysema, when observed in connection with disappearance of phthisical symptoms, is an effect, not the cause, of modified constitutional state.

IV.—INTERLOBULAR EMPHYSEMA.

1031. Accumulation of air in the connective tissue between the lobules, and in the interspaces of the cells, anatomically characterises interlobular emphysema. Very seldom associated with the vesicular variety, interlobular emphysema is acutely produced by sudden rupture of air-cells, leads to infiltration of air into the mediastina and lays the ground-work of one variety of external sub-cutaneous emphysema.

1032. Interlobular emphysema is commonly the result of violent efforts, which require the abrupt introduction of a large quantity of air into the lungs, and its forcible retention therein by closure of the glottis. The efforts in parturition, defecation, raising weights, coitus, violent coughing, paroxysms of rage, excessive laughter,* and hysterical convulsions, have all been occasionally followed by rupture of the air-cells, by interlobular, and occasionally by subcutaneous, emphysema.

Some while since I found in a tuberculous youth,† who had had profuse hæmorrhage from the lungs for three days, such amount and quality of percussion-resonance at both sides of the back of

* Case narrated to me by Mr. Graham, late Master of the Mint.

† In conference with Dr. Sutton.

the chest, as might be expected to indicate bilateral pneumothorax. But breath-sound, though weak, reached the surface; and the continuance of life would probably have been an impossibility with such accumulation of air in both pleural sacs. Meanwhile the cause of the excessive resonance remained mysterious enough till the evening,—when free infiltration of air set in from the mediastinum to the areolar tissue of the neck and chest-wall. Whether the interlobular emphysema arose from rupture through violent cough, or from breakage of tissue by forcible blood-infiltration, the case is equally remarkable, and stands the solitary instance of the kind in my experience.

1033. Carried to extremes, interlobular emphysema may cause sudden death.* Martini enumerates forcible lung-insufflation among the modes of perpetrating infanticide. The experiments of Leroy d'Etiolles on animals show that death may thus be produced as suddenly as by dividing the medulla oblongata. Ollivier records the case of a man who suddenly fell dead, in a quarrel with a comrade, from the asphyxia entailed by extensive interlobular emphysema.

1034. When added to any amount to pre-existent vesicular emphysema, it must gravely increase dyspnoea: the occurrence is fortunately very rare.

1035. Are there any special signs of interlobular emphysema? I know of none. It is quite possible, as Laennec originally taught, that, if the surfaces of the interlobular spaces become prominent through distension, grazing, dry, friction-sound may be heard; but there will be nothing distinguishing the sound, thus produced, from that caused by the sub-pleural sacculi of advanced vesicular emphysema. The same observations apply to Laennec's "dry, crepitant rhonchus, with large bubbles."

The percussion-tone, as we have just seen, may simulate that of pneumothorax.

O. —HYPERTROPHY OF THE LUNG.

1036. Hypertrophy of the lung, unless when accidentally occurring as a local and adjacent effect of emphysema, cannot be regarded in the light of a disease. It arises as the result of inaction of the fellow-organ, as when this has been compressed and rendered permanently useless by empyema. Or, if the influence at work play upon the entire pulmonary mass, both organs enlarge. The most striking illustration of this general increase of bulk

* *Cyclopædia of Surgery*, art. "Emphysema," p. 79.

occurs in the inhabitants of elevated regions; the lungs, and consequently the width, as well as height, of the chest, enlarges so much, as to produce an unseemly disproportion to an eye, accustomed to the standard of flat portions of the earth, between the dimensions of the torso on the one hand, and the length of the limbs and total stature, on the other. M. d'Orbigny found the air-cells of the Inca race, largely dilated according to the European average, as well as the mass of the lungs huge,*—the elevation of their habitations above the sea-level, varying from 2500 to 5000 metres. The heart, too, enlarges.

1037. The mere fact of altitude of habitation, calling for perpetual effort in the breathing-act, sufficiently explains this massy pulmonary development. So great is this effort, that in some inhabited places of great elevation and extreme rarity of the air, all strangers, and many even of those "to the manner born" are unable to walk and speak at the same time. Potosi, at an altitude of 13,265 feet above the sea-level, may be given as an instance in point.

1038. But, beyond this, I am persuaded a difference in the bulk, weight and form of the lungs holds in different populations occupying soils at exactly the same height above the sea-level; and this difference in extreme probability depends upon race. Researches are wanting on this subject. And the first step in such enquiries must be to forget what is taught in books of anatomy concerning the normal weight of the lungs; the usual statement is decidedly above the reality in consequence of the balance being applied to organs more or less congested in *articulo mortis*. Lungs really normal in all respects weigh in Londoners not more than from nine to twelve ounces each.†

Meanwhile, and while awaiting careful investigations, who, in the habit of examining chests, can doubt that the habitually puny thorax of the Anglo-Saxon, with its flattened front and its rounded scapular regions, contains a less *quantum* of breathing tissue than the splendid torso of the Spanish pedlar, or the Neapolitan jazzozone, with its arched front and quasi-perpendicular back?

1039. The absolute bulk and weight of a hypertrophous lung are increased; the substance of the alveolar walls may thicken considerably. The cells are large,—sometimes morbidly dilated. A lung thus affected, either collapses slightly or not at all, and may

* Vide Morel, *Traité des Dégénérescences*, p. 27; also, Arch. Scith. Ed. Philos. Journal, p. 51. 1873.

† Tuck, U. C. H., *Females*, vol. ix. p. 67, etatis 32 the right lung weighed only nine ounces.

actually protrude, when the chest is opened after death. Whether the pulmonary and bronchial arteries enlarge is unknown.

1040. The amount of breathing work performed by a highly hypertrophous lung greatly exceeds that done by a normally healthy organ,—at least as far as physical signs may be accepted in evidence. It may be inferred from these signs, the effective oxygenising surface actually undergoes increase.

1041. The side may become considerably dilated; if the hyper-nutrition be limited to one lung, this is very easily ascertained. The percussion-sound acquires the characters of Type II. [107], the vocal fremitus increases, the vocal resonance becomes strong, and the respiratory sounds exaggerated and harsh, with an undue amount of expiration. Emphysematous distension of the air-cells sometimes advances *pari passu* with hypertrophy.

D.—ATROPHY OF THE LUNG.

1042. (a) *General*.—The density of the lungs and the quantity of blood, they admit, diminish with age; their structure undergoes throughout a normal atrophy.

1043. Hourmann and Dechambre* describe three types of change in intimate structure of the lungs of the aged. In the least advanced the air-cells are rounded and considerably enlarged: in the second stage, the cells elongated into ellipses, so as to look like chinks, are still further enlarged; while the lobules present the same elliptical outline: in the third, the air-cells, greatly enlarged, uneven in size and, without distinct form, give the appearance of torn net-work to a dried section of the lung; the distinction into lobules is lost.

1044. The loss of vesicular walls and of inter-vesicular substance diminishes the positive bulk of the lung: the thorax contracts in consequence. The extent of aerating surface undergoes great reduction also; but as the mass of blood gradually lessens, no dyspnoea occurs. The chest-walls sink in; and in some highly marked cases serosity accumulates in the pleura to fill the space which would otherwise be left empty, through the inability of the chest to follow beyond a certain point the dwindling and receding lungs.

1045. (b) *Local*.—Local atrophy forms an important secondary constituent of a variety of pulmonary diseases; and, according as diminution in the amount of circulating blood occurs or not, will

* Arch. Gen. de Médecine, 1835.

obstructed breathing and subjective dyspnoea ensue, proportionally to the extent of wasted texture.

1046. Thus, atrophy forms an essential element of vesicular emphysema. Local wasting of the parenchyma follows its infiltration with induration-matter, tubercle, or carcinoma. Mediastinal growths or aneurism, interfering with the supply of blood by pressure on the bronchial or pulmonary arteries, impede nutrition locally. Pressure on a main bronchus, if long continued, first causes collapse of the lung, and subsequently atrophy from inaction. Further, exudation-matter in the pleura sometimes tightly embraces a portion of lung, and causes its atrophy by obstruction of its vessels.

1047. (*c*) *Acute*.—Attention has recently been drawn by Dr. Buhl of Munich, to a presumed form of acute atrophy of the lung, occurring in typhoid (Peyerian) fever, and essentially characterised by destruction of the alveolar walls, coupled with collapse of tissue and dilatation of the minuter bronchi.* The process described seems to be one of low pneumonia, with tendency to local gangrene.

II.—CONGESTION OF THE LUNG.

1048. Congestion of the lung is of mechanical, passive or active mechanism.

A. —MECHANICAL CONGESTION.

1049. The lungs may be mechanically congested as a result of (*a*) undue attraction to, or of (*b*) undue propulsion of blood towards, their vessels,—or through the influence of (*c*) some physical obstruction to the onward passage of their blood to, and through, the left heart.

1050. (*a*) The phenomena of effort illustrate the first mechanism. A full inspiration draws blood copiously to the pulmonary capillaries; the glottis is closed, and the blood partially fixed in its position. Hence the eccentric pressure on the capillaries undergoes a remarkable increase, which occasionally finds relief in extravasation. If hæmoptysis ensue, the blood is vividly arterial in tint.

1051. Again, when the body has been exposed to intense cold, threatening congelation, the pulmonary capillaries, contracted by the frigid air inspired, circulate less than the normal quantity of blood. If, under these circumstances, the frame be suddenly placed in a heated atmosphere, the capillaries dilate, and blood is

* Ranking's Retrospect. vol. xxvi

mechanically attracted in relatively enormous quantity, whence stagnation and asphyxia follow.*

1052 (*b*). It has been habitually held, that increased weight of the atmosphere must drive the blood from the surface, and determine internal congestions, especially of the lungs and brain. The employment of the Compressed Air-Bath seems to have demonstrated that such apprehension is illusory. The equilibrium of pressure in all directions prevents the anticipated result. And even conceding that extra propulsion towards the lungs occurs, the effects of this must be rendered comparatively light through the slackening influence of the increased pressure on the circulation, the pulse being often reduced in the Compressed Air-Bath by twelve or fifteen beats in the minute.†

1053 (*c*). The conditions of the left side of the heart, which obstruct the exit of blood from the lungs are, essentially, disease, obstructive or regurgitant, of the mitral orifice,—and, in a less degree, flabby dilatation of the left ventricle. The former state produces the congestive effect through physical impediment; the latter through dynamic incapacity. The results of the congestion, low pneumonic exudation, œdema, pulmonary apoplexy, and hæmorrhage, rank among the important clinical conditions of those cardiac diseases.

1054. In the classes (*a*) and (*b*) the congestion anatomically resembles the active variety; in class (*c*) more nearly approaches the passive.

1055. *Treatment*.—Congestion of this kind is most effectually relieved by cupping, dry-cupping, counter-irritation, diuretics, and purgatives.

B.—PASSIVE CONGESTION.

1056. In all diseases of adynamic and exhausting character, there is a tendency, more or less marked, to accumulation and stagnation of blood in the most dependent parts of the lungs,—commonly, of course the posterior bases.

1057. *Anatomical Characters*.—This congestive state, purely a result of failing vital power, has frequently been described as a form of pneumonia, under the title of *hypostatic*. As a general rule, the distinction from actual inflammation may be effected through the following characters. Congested tissue is externally less deeply livid, internally shows blood-staining, partially re-

* Larrey, while following Napoleon in his Russian Campaign, had frequent occasion to observe fatal engorgement of the pulmonary and cerebral capillaries, when soldiers, benumbed with cold, approached to or near the bivouac fires.

† Bertin, du Bain d'Air Comprimé, p. 62.

moveable by washing,—it collapses more,—crepitates more,—furnishes more markedly frothy, and less markedly red, liquid on section, is of lighter specific gravity, and firmer in consistence than inflamed substance. Besides, congestion commonly implicates, and to an equal degree, the posterior aspect of both bases,—inflammation one base only, or, if both, these to very different amounts.

In exceptional instances, especially where the blood is hypinotic, congested tissue may break as readily under pressure as if it were inflamed; and, sometimes from the mode of decumbency before death, sometimes from inexplicable causes, either lung may be much more involved than its fellow. The presence of exudation-cells and blastema in any quantity will depose unmistakeably in favour of inflammation; but I believe cell-growth on a limited scale to be perfectly compatible with mere passive congestion,—exosmosis of liquor sanguinis, through hydrostatic pressure, supplies the blastema.

1058. *Symptoms*.—Passive congestion gives rise to but one local symptom, dyspnœa. Now this dyspnœa proves, both subjectively and objectively, much less serious than might fairly be expected, considering the great mass of lung-substance oft-times severed from all oxygenizing action. In point of fact where this variety of congestion occurs, failure of nervous impressionability has already set in; and a state of general hypæsthesia been induced either from the nature of the primary disease (as in adynamic fevers), or from the near approach of death: the whole condition of the patient, including diminished *besoin de respirer*, imitates by anticipation the coming death-struggle. Similarly, neither local pain, cough, nor expectoration occur.

1059. *Physical signs*.—The percussion-sound, of Type L, is raised in pitch and toneless,—the respiration coarse, faintly or markedly bronchial, accompanied with a little rhonchus finely bubbling or crackling in character, or with none; while the vocal vibration and resonance commonly range above par.

1060. *Treatment*.—Where the tendency to such congestion exhibits itself, occasional change of posture from the back to the sides, or even to the prone position, is one of the most important remedies. The medicinal and dietetic management should be tonic and stimulant.

C.—ACTIVE CONGESTION.

1061. Active or arterial congestion may affect both lungs more

or less extensively, one lung, or a portion (generally the middle height, or the apex) of either organ.

1062. *Anatomical characters.*—The anatomical characters are with difficulty established; seeing that congestion scarcely destroys life *per se*, but only through its issues or terminations, the characters of these are mixed up with its own. I have, however, since the last edition of this book was published, seen three most indubitable examples of fatal active congestion. In one only of the number had I an opportunity of post-mortem examination.* Now in this instance the essential anatomical constituents were arterial injection of bright vermilion tint, excess of blood of that tint, abundant aëration, dryness of feel, with very slight, if any, perceptible increase of specific gravity.

1063. Active congestion may occur as a primary state; or ensue upon various organic affections of the lung, especially tuberculization, chronic or acute,—occurring in typical perfection in the latter case; or result, in rare instances, from over-excited action of an enlarged right ventricle.

1064. *Issues.*—Active congestion may disappear without going further,—as it not unfrequently does in measles; it may constitute the first stage of pneumonia; or it may find vent in hæmorrhage by capillary molecular perforations, or by rupture of a vessel of some size,—this, however, with infinite rarity, unless tubercle, cancer, or other grave organic disease pre-exist in the lung. This form of congestion never, within my knowledge, leads to true pulmonary apoplexy.

1065. *Symptoms.*—Active congestion produces dyspnoea with suffocative and uneasy feelings within the chest, with slight, or without actual, pain; the uneasiness may be limited to the spot, where the physical signs localise the congestive process. The patient lies with the head high. There may be lividity of surface; the respiration is variably accelerated; troublesome, even urgent, cough, with frothy, somewhat viscid, muco-epithelial expectoration, occasionally containing blood-discs, perceptible under the microscope, but insufficient to tinge the fluid to the naked eye, commonly ensues.

Much general excitement and distress occur in well-marked primary cases. The intenseness of the general anxiety is, in truth, occasionally the most striking feature in the case.

1066. *Physical signs.*—It has been theoretically taught that the percussion-sound is more or less dull, the very reverse is the fact.

* In conference with Mr. Culpeper, of Notting Hill.

In all three cases, just alluded to, the percussion-sound was of Type II., that is the volume of tone increased above par, and its pitch lowered. And this really accords with the abundant aëration noted among the anatomical conditions of the disease [1062]. The circular measurement of the thorax, as Woillez has shown, increases. The respiration-sound loses in strength, rises in pitch, and becomes rough in quality,—but all this to a very slight amount. A dryish, rather fine, sometimes, however, distinctly bubbling, rhonchus may be heard in secondary active congestion; but I am uncertain as to the existence of any rhonchal sound in the primary disease. The pulse is relatively less accelerated than the breathing, and the temperature may not be raised.

1067. The signs are almost always bilateral.

1068. *Prognosis*.—Abrupt in its onset, primary congestion is commonly rapid in its course. It may end in speedy recovery, or in transition to some other state [1064]; or it may, in a few hours, destroy life. I have seen enough to justify me in warning the young practitioner against a too favourable view of a case of the kind, because the patient is free from any other disease.

1069. *Diagnosis*.—To determine the existence of the congestion is the first, but only the first, element of the diagnosis. This is to be done through the association of sudden dyspnoea and general anxiety with the positive and negative physical signs just enumerated, increasing circular measurement, increased mass of percussion-tone, and absence of the signs of pleurisy and pneumonia.

But, the existence of the congestion being established, how are we to determine whether it is idiopathic, to end, as it began, an isolated condition (either by recovery or by death), or the initiatory condition of some other affection soon to follow? I am unable to give a satisfactory reply to the question. But as far as I have seen, the more intense the phenomena of the congestion, the more likely the attack to be purely idiopathic.

From neurotic dyspnoea [931] and from hæmic asthma [1467], it can only be separated through the certain absence of the special attributes of each of those affections.

1070. *Treatment*.—In cases of general congestion, supervening abruptly, and rapidly assuming a very threatening aspect, an effort must be made at once to lessen the quantum of blood in the pulmonary vessels. If the patient be constitutionally sound and strong, a moderate quantity of blood should be taken from the arm. If there be evidence that the congestion affects only a limited area, cupping the surface may be substituted. On the

other hand, if the patient be feeble, or more or less anæmic, dry cupping of the chest should be substituted, or, better far, Junod's exhausting boot applied to a lower extremity.

The intensity of the dyspnoea and general anxiety may be greatly relieved by inhalations of small quantities of chloroform; and by the free application of mustard to the lower limbs. If, exceptionally, there be sharp pain in the side, cupping, dry cupping, or a blister is indicated.

A colocynth and calomel pill, followed by a turpentine and assafoetida enema to free the intestinal tract,—and the hot-air bath to determine towards the skin, are agents of importance.

Antimonial and diuretics may be employed internally.

D.—LOCAL CONGESTION.

1071. Local congestion attends, either as a precursor or as a sequence, the generation of various morbid products in the lung. The chief practical interest of this form of blood-stasis lies with its dependence on tuberculous disease,—and to the natural history of that affection its consideration is deferred.

The notion, affiliated to some respectable names, that congestion may persist for an indefinite term at an apex as an isolated condition, give rise to minor consolidation-signs, and affect the general health, after the model of tuberculous disease, cannot, in my mind be accepted for a moment. That such a doctrine opposes general rules of pathology and physics is even less fatal to its acceptance than the fact, that no one has ever yet demonstrated its reality. On the other hand, there are clinical grounds for believing that the removal of associated local congestion may lessen the markedness of consolidation-signs due essentially to solid material of some kind or other.

III.—PNEUMONIA OR PERI-PNEUMONIA.

1072. The term pneumonia has taken its place in medical nomenclature as the representative of a variety of pulmonary inflammation-processes widely differing in significance, in nature, and in issue. It is proposed to pass in review the chief of these varieties.

ACUTE STHENIC EXUDATIVE PNEUMONIA.*

1073. *Anatomical characters.*—Acute inflammation of the pulmonary tissue, or pneumonia, has habitually been divided into three

* For the convenience of the student it may be well to observe, this is the form of pneumonia designated in German literature by the odd title of "Erschöpf".

anatomical stages.—those of engorgement, of red hepatization, and of gray, or yellow hepatization.

1074 *a*. In the stage of engorgement, the external surface of the affected parts is of livid or violet colour, or mottled with both tints and with dull red; the weight of the organ is increased, its elasticity diminished; it retains marks of pressure like an oedematous lung; and crepitates imperfectly. On section reddish spinous serosity escapes in greater or less quantity; the spongy character of natural lung is still to be recognized; the consistence is diminished. The permeability to air is lessened, not destroyed; the tissue floats in water, even after forcible pressure with the fingers.

1075 *b*. In the next stage the section of the inflamed part presents a rude resemblance to the liver, hence the name of red "hepatization." The outer surface is commonly redder, less livid, than previously; the specific gravity, as well as the absolute weight, is more or less increased,—the tissue rapidly sinking in water; all natural elasticity is gone; the texture quasi-solid. On section the surface proves generally of red tone, not uniformly red, but mottled, or, as it were, veined,—a variegated character increased by the different hues of the bronchi, vessels, black pulmonary matter and interlobular septa. Fluid escapes on pressure, but in less quantity than before; it is thicker, more bloody, and more or less completely airless. The surface looks either smooth and planiform, or beset with a multitude of red, granular-looking eminences, particularly obvious if the texture be torn: in the latter case the air-vesicles especially, in the former both vesicles and inter-vesicular spaces, are loaded with exudation. The absolute volume of the organ increases; hence it encroaches on the mediastinum, enlarges its side of the thorax, and takes the impress of the ribs. Its weight may increase to six or eight times, its specific gravity to nearly double, the natural amount.

1076. In new-born infants the granular aspect is quite wanting, even when the tissue is torn: in advanced age granulation on a large scale, with empty spaces interspersed through the lung, occasionally presents itself. The minuteness of the vesicles at birth, on the one hand, and the frequency of pulmonary atrophy or emphysema in aged persons on the other, explain the conditions peculiar to each period of life.

1077. There is a variety of this stage in which the inflamed tissue of vinous red, or livid tint, heavy, impermeable, containing very little fluid and no air, with a uniform smooth non-granular

section, proves really firm and resistant. This state indicates the existence, prior to inflammation, of pressure-condensation or collapse, and its occurrence is rare, for reasons made clear in the description of those states [952]. It has often been spoken of as *caruification*,—a term which, in this sense, it is safer to avoid, as it has been also applied to the state of simple condensation without inflammation.

1078. The inflamed lung is sometimes peculiarly soft, almost pulpy, breaking down under the slightest pressure, and gorged with thickish claret-coloured non-aërated blood; on this state the term *splenisation* has been bestowed. Its peculiarities seem to depend on the constitution of the blood; it is most common either in persons cut off acutely by adynamic affections in which that fluid is hypinotic (such as continued fever), or in those worn down by previous old-standing disease.

1079 (c). In the following stage, that of yellow hepatization, several of the properties of the second remain substantially unaltered. The organ is still, in its affected parts, dense, heavy, enlarged, impermeable; the specific gravity greatly increased, the friability of texture even greater than before. But the colour, on section, has undergone a more or less complete change. The general tint has grown yellowish or yellowish-gray,—sometimes granite-like from spotty intermixture of the black matter of the lung. The granular character may be still, though faintly, retained.

1080 (d). Dr. Stokes contends that a stage of pneumonia prior to that of engorgement exists,—distinguished by dryness and bright vermilion colour, and constituted by intense arterial injection. Skoda denies this, and with Rokitsansky looks on this coloration as the product of anæmia. My opinion coincides with that held by Dr. Stokes. The vivid arterial tint in question is seen to perfection in rapidly fatal cases of acute miliary tuberculization, in persons presenting none of the acknowledged characters of anæmia, but many of those of pneumonic irritation. Besides it may exist in one lung and be absent in the other,—a fact which seems to me even taken alone to settle the question.* Its characters are essentially those of acute active congestion [1061]. And further, in cases of intense general anæmia, the lungs look pale and bloodless,—locally congested and hæmorrhagic spots standing out in strong relief on a colourless ground.†

* Knowles, U. C. H., *Males*, vol. x. p. 175.

† Monk, U. C. H., *Males*, vol. xii. p. 85, —death from *pnce anæmia* without leucœmia.

1081 (*e*). Abscesses, varying in dimensions from that of a nut to that of the clenched hand, one or more in number, sometimes form in a part affected with gray hepatization. Commonly seated near the pleura, they may perforate this membrane and produce pneumothorax,—an event, however, of extreme rarity. The cavity of such abscesses is irregular, traversed by bronchi, vessels and fragments of tissue; the walls are formed of pulmonary substance, either bare, or lined with a pyogenic membrane, which sometimes forms with great rapidity.* Minute sloughs may form secondarily on the walls. The pyogenic membrane may eventually become pseudo-mucous, and the cavity fall into a quiescent state symptomatically; or actual cicatrization may occur.

Amid the contents of pulmonary abscess, essentially composed either of landable or sanious pus, fragments of parenchyma, occasionally of some bulk, are now and then discernible.

Abscess is more common towards the apex of the lung than elsewhere; advanced age seems favourable to its occurrence.

1082 (*f*). The inter-lobular and inter-lobar cellular-tissue may inflame and suppurate; † or, as shown by Dr. Stokes,‡ the pleura may be dissected from the lung by suppuration. These exceptional interstitial processes have no necessary connection with parenchymatous pneumonia.

1083. There may then with propriety be admitted four stages: 1. Arterial active congestion; 2. Venous stagnation; 3. Plastic exudation; 4. Softening of plastic exudation, or suppuration.

1084. *Microscopical characters*—(*a*). In the first stage the congestion of the capillary system of the lung is accompanied with commencing stagnation, but unattended with escape of blood-elements, or separation of these from each other. The tissue, we have seen, is drier than natural.

The capillaries of the pulmonary artery are those essentially affected; that those of the bronchial arteries are likewise involved seems infinitely probable, though as yet undemonstrated; but I cannot believe, in spite of the advocacy of Dr. Morehead,§ that the bronchial capillaries are those mainly concerned in parenchymatous inflammation. He argues that inflammation, being a perverted nutrition-process, must take place in the bronchial arteries, because they nourish the lung. That they are the sole nutrient vessels

* A case, recorded by Grisolle, shows that seven days will certainly suffice for the purpose.

† Carswell's Drawings, U. C. Museum, No. 57, C. b. 573.

‡ Dublin Journal, 1833.

§ Disease in India, vol. ii. p. 311. A work of genuine clinical worth.

is more than unlikely [1177]: but, conceding this, it must be remembered tuberculation is, yet more decidedly than inflammation, a perverted nutrition-process. Now, Schröder and Guillot have shown, by fine injections, that the pulmonary artery undergoes obliteration, while the bronchial arteries remain perfectly pervious during the tuberculating process.

1085 (*b*). In the stage of engorgement, the capillaries become still further loaded, and encroach on the cavity of the cells; exosmosis of water, stained with hæmatin, and to a slight extent escape of blood-disks and liquor sanguinis, ensue. Granular epithelium and free granules, even a few exudation corpuscles, may be seen.

1086 (*c*). In the stage of red hepatization, the serum, red disks and plasma escape copiously into the vesicles, infiltrate their walls, and accumulate in their interspaces. Formative processes become active; exudation-cells and compound granular corpuscles (fat) distend the vesicles; free fat granules, protein granules, and fibrillated, amorphous or flakey protein particles are seen. Such epithelium, as can be traced, is highly fatty. The colouring matter of the blood infiltrates the cell-walls; but, as originally shown by Gluge,* the pulmonary fibres may be brought into view by washing. The fibrinous casts of the vesicles and ultimate tubes, described by Remak, are rarely to be seen.

1087 (*d*). Even in the stage of grey hepatization, actual destruction, macerative or other, of the lung-fibres does not occur. Gluge† affirms that gray hepatization is "constantly a genuine suppuration" of the lung. This is very certainly incorrect; true pus-cells abound doubtless in some cases, but they are rare in others,—and in yet others cannot be found, exudation-cells being alone visible. The naked-eye appearances of suppuration are consequently sometimes simulated by liquified exudation-matter.† The quantity of granular fat and oil-drops still further increases.

1087 (*e*). The material of so-called abscesses is sometimes merely liquified exudation-matter.

1088. *Chemical characters*.—M. Guillot ascertained some years since, that whereas the natural proportion of fat to parenchyma averages about 10 per cent., it may rise to 50 per cent. in pneumonia. Doubtless, from the impermeability of the capillaries,

* Anat. Mikros. Untersuchungen, H-ft. i. p. 60. Minden, 1838.

† This passage, from the edition of 1854, appears to have escaped the attention of Dr Da Costa, who, in an interesting essay on the Minute Anatomy of Pneumonia (Amer Journ Med Sciences, Oct 1855), looks upon the announcement by himself of the frequent absence of pus-cells as a novelty. I have known and taught the fact in my lectures since 1847.

products which should be oxidised in the act of respiration, fail to undergo that change, and form new combinations. The quantity of fat will increase directly as the amount and duration of obstruction to breathing. The increase of fat with the progress of the disease may be traced microscopically [1086]. There can be little question, too, that when actual suppuration occurs in the stage of gray hepatization, the quantity of fat will attain its maximum.*

Sugar, also, would probably be found, if hepatized tissue were examined immediately after death.

The peculiar acid (pneumic) of the lung-substance, described by Verdeil, appears to undergo increase in pneumonia. In a single hepatized lung of a male there was a very considerable greater quantity of the acid, than in both lungs of a perfectly healthy guillotined woman.†

1089. *Physical Signs*.—The physical signs of acute pneumonia vary with the amount of consolidation, and the nature of the material poured into the cells,—hence, with the various stages of the disease.

1090 (a). Are there any special signs of the *stage of arterial injection*? Previously to the occurrence of crepitant rhonchus, the following conditions may sometimes be detected. The breathing-sounds reach the ear weaker, harsher, and rougher, and of higher pitch than natural from the affected part, provided this be near the surface‡ [1067]. If the structure involved be deep-seated, on the contrary, exaggerated respiration, from the intervening healthy tissue, is heard. I have now seen a fair number of cases in which such exaggerated respiration, coupled with febrile excitement, and slight pain in the side, were the earliest indications of a central pneumonia, eventually travelling to the surface.

If the quantity of lung involved be considerable, the percussion-note will fall in pitch and increase in amount of tone; if the area be limited, the percussion-sounds will be normal.

1091. M. Grisolle states that he has, in a large proportion of cases, found weak respiration, in the neighbourhood of already hepatized lung, the precursor of signs of consolidation: this statement I can confirm; in some such instances no crepitation can be caught from day to day, while the spread of the disease is indicated by percussion-dulness and bronchial breathing.

* In some species of pus, fat constitutes as much as 29 of 114 parts, representing the solid ingredients in 1000 parts.

† Robert Verdeil, *Chimie Anatomique*, t. ii. p. 150.

‡ Styler, C. C. H., *Miles*, vol. x. p. 54.

1092 (*b*). In the *stage of venous stagnation*, the movements of expansion and of elevation are, if pleuritic pain be present, somewhat restrained. The vocal fremitus maintains its natural standard.

1093. The percussion-sound acquires to a slight extent the characters of Type I. [195],—the amount of tone diminishing,* its pitch rising. Any serious change in these respects proves a great amount of sero-venous stagnation,—or renders it possible that an intermingling of actual exudation has already occurred.

1094. The respiration-sound loses strength, and may be even locally suppressed, or masked by rhonchus, in the affected parts and their confines, exaggerated in those at some distance from them and in the opposite lung; the vocal resonance is somewhat intensified, and slightly sniffling in quality.

In a considerable majority of cases, watched from the outset, crepitant rhonchus [318] is more or less extensively heard during this stage; but, in hospital practice especially, the period of its existence has often passed when the patient is first seen. There are instances, too, in which, though the pneumonia be developed under observation, no crepitation occurs: here intra-parenchymatous exudation seems to be thrown out so rapidly, as to arrest all breathing action in the actually inflamed part, *ab initio*. And in a word, the diagnosis of pneumonia must often (on a rough estimate probably once in every three or four cases) be made without the help of true crepitant rhonchus.

1100 (*c*).—In the *stage of red hepatization* the form of the chest may undergo slight change, independently of the presence of pleuritic effusion. In a small minority of cases I have found positive, though slight, increase of width by measurement at the base of the affected side. M. Grisolle reports two cases showing that the infra-clavicular regions may bulge under the pressure of pneumonic enlargement. Besides, the evidence of slight encroachment of the inflamed organ on the mediastinum may very frequently be obtained by percussion at mid-sternum; the attendant dullness may reach a quarter of an inch beyond the middle line.

* Skoda appears to maintain that in this stage the percussion-sound remains unaltered (Markham's Translation, p. 269), on the ground that no possible amount of congestion of the blood-vessels can change it. But, conceding this latter point which the illustration of the normal lung resonance in mitral disease fails in my mind to prove, as slight deficiency of tone posteriorly is often, according to my experience, observable in that cardiac affection, it must be remembered that escape of serosity into the parenchyma takes place during the congestive stage of pneumonia. The question is a totally different one from that of the resonance in the condition of arterial congestion [1092].

The heart, too, may undergo slight lateral displacement.* General expansion of the side is never the resultant of pneumonia alone.

1101. The expansile movement of the chest, and even the abdominal movement, are lessened in amount on the affected, somewhat augmented on the sound, side, —and this in simple pneumonia with extensive consolidation, quite independently of the influence of severe pain. But the movement of elevation is not by any means so much obstructed, according to my observation, as that of expansion; a circumstance which will perhaps account for the contradictory opinions held concerning thoracic motion in the disease. In certain cases of pneumonia with a slight amount of plastic exudation on the pleural surfaces, friction-phenomena are not to be discovered. To what can this be attributed, but to the diminished expansion of the lung, and deficient mobility of the thoracic walls? while, on the other hand, it would be preposterous to explain the diminished motion by the interference of the painless pleuritic exudation supposed.† The respiratory play is impaired, not only by want of expansile, but of contractile power on the part of the lung: I have known the latter even more deficient than the former: the elasticity of the texture is wholly destroyed.

1102. As a rule the vocal vibration is increased in intensity; sometimes simply maintained at the normal average;‡ while in cases of exceedingly extensive, and, as it were, massive hepatization, it may actually fall below the natural standard. Fortunately this is rare. [76, 77.] A vibratile tremor is sometimes conveyed to the surface through the lung from the heart,—sometimes generated by the pulsation of its own vessels.

1103. The percussion-sound is always of abnormal type; and its principal peculiarities may be stated as follows:—(a) Types I. and III. [194], those of *dulness* or of *hardness*, are the usual conditions. The quality is always modified, the pitch raised, the resistance increased. (b) Absolute dulness on firm percussion very rarely exists; and the note may be “clearer” over highly consolidated

* On the other hand, if such displacement be to any amount, say as much as an inch and a half, the presence of pleural fluid may be looked on as certain.

† Even where the consolidation of the bases is extreme, and the amount of pleural lymph very small, there may on the other hand be well-marked friction-sound. Skinner, U. C. H., *Males*, vol. ix. p. 98: here the lungs, though emphysematous, weighed 37½ oz. and 42½ oz.

‡ When pneumonia supervenes on extensive emphysema, this will be the case; the vocal resonance may be less marked over the pneum. than the simply emphysematous parts, and yet the fremitus be well maintained over the former,—on the right side. Skinner, U. C. H., *Males*, vol. ix. p. 95.

tissue than over healthy lung [137]. (c) The morbid quality is either wooden, tubular, amphoric, or, in infinitely rare instances, genuinely tympanitic [217]. (d) The former three varieties of morbid quality may be rendered more intense by proximity of hollow organs, the stomach or distended colon, to the hepatized part, or by inclusion of large bronchial tubes within its area (as originally suggested by Dr. Hudson); but they may exist in perfection at the right base posteriorly,* as well as at the left, and also in the axillary regions. (e) While the hepatized base gives tubular resonance, that of the non-pneumonic apex may be of exaggerated character (Type II.). (f) While the hepatized base gives dull resonance of Type I., the non-pneumonic apex may somewhat lose its normal pulmonary tone,—but this never becomes tubular, as it does where fluid has accumulated inferiorly. (g) The amount of tone and of abnormal quality in the same spot varies, or rather may vary, within brief periods: the change may be referrible to the states of bronchial accumulation, or to varying flatulence in the abdomen,—or prove inexplicable. (h) The superficial area of the hepatized tissue is sometimes sharply, sometimes feebly, defined by the percussion-signs. In this aspect the sense of resistance is a safer guide than the tone; for unquestionably conduction exercises a disturbing influence in a sideward or horizontal direction as well as in a direct, or vertical, line [221].

1104. The surface over the solidified tissue furnishes blowing respiration of the diffused or tubular varieties, sniffling, metallic, abrupt and divided in rhythm; the denser the hepatization, the more metallic the quality. In distant parts the respiration is exaggerated. No crepitant rhonchus forms in the actually hepatized part, but, generated on its confines may be heard therein only, or, also conducted through the dense tissue, may be accidentally caught through the loud inspiration-sound.

Bronchophony, sniffling, metallic and intense, sometimes quasi-ægophonic, ranks as the special form of vocal resonance. But the most perfect pectoriloquous whispering bronchophony may occur,† or the first resonance may be followed by a separate whispered echo.‡ Bronchial cough and unnatural intensity of transmission of the heart's sounds, complete the list of discoverable signs.

Sonorous rhonchus, erroneously referred by Laennec to compression of the bronchi by the indurated pulmonary tissue, is an accidental, and, in the adult, rare effect of co-existing bronchitis.

* Lewis, F. C. II., Females, vol. ix. p. 340.

† McLean, F. C. II., Males, vol. xii. p. 181.

‡ Wright, F. C. II., Females, vol. xv. p. 14.

1105. Of all the signs, the intensified vocal fremitus, the abnormal percussion-note, and the metallic tubular breathing, are the most important.

1106. *Exceptional signs.*—(1.) In certain rare cases of pure red hepatization, the physical signs, with the exception of dullness under percussion, are wholly wanting; the vocal fremitus is deficient; there is neither vocal resonance nor respiration heard on the affected side. These peculiar conditions seem probably to depend on such extensive closure of bronchial tubes, as to prevent the possibility of reinforcement of respiratory or of vocal sound within them, while the side is motionless, and the powers of conduction of the lung (which, we know, vary widely according to the precise acoustic conditions of the hepatized substance [425, *d*]) are annulled. Pressure on a main bronchus by an enlarged gland or tumor, if of sufficient size to obstruct the tube completely, will produce this effect on the signs; but such pressure is not a necessary condition.

(2). A more singular state of things still may exist. Tubular respiration may be intermittent,—sometimes existing, sometimes no respiration being audible. I have traced this in one instance to pressure on the main bronchus of the affected side,—obviously acting at various moments with different amounts of force.*

1107 (*d*).—In the stage of *gray hepatization*, interstitial suppuration, or liquefied exudation-matter, the signs are essentially the same as in the previous stage. If suppurating or liquefied spots freely communicate with bronchial tubes, loose liquid rhonchus, more or less thin and high-pitched, according to the more or less completely purulent quality of the fluid in the lung, will be produced. But such communication is, of course, a matter of accident; and, admitting the occurrence both of communication and rhonchus, I know of no character by which such rhonchus can be positively distinguished from bubbling rhonchi arising in tubes surrounded by consolidated tissue.

1108. There may, too, as in the previous stage, and through the same causes, be complete absence of all auscultatory signs. I saw a remarkable case of this kind several years ago, with Dr. Storrar: there were neither respiration-sounds nor rhonchi audible in front of the chest, directly over lung thoroughly infiltrated with yellow semi-liquid exudation; dullness the most absolute was the only physical sign in the spot.

1109. *Signs of resolution.*—The resolution of pneumonia may

* Beckett, U. C. H. J. Males, vol. v. pp. 231, 271.

occur, in some very rare instances, before red hepatization has been effected; but in the vast majority of instances, the disease has advanced to the hepatized stage before resolution commences. The signs of this favourable event are, first, a change in the quality of the tubular breathing; it falls in pitch, becomes less sharp and metallic, more open—in a word, of diffused blowing type, a change serving as a transition to a harsh and weak respiration. The bronchophony rapidly loses its peculiar sniffling quality, but holds on to a slight amount for some time; while either *redux* crepitant or fine bubbling rhonchus, becomes, and remains, audible for a variable period. The percussion-sound, gradually falling in pitch, grows pulmonary, and, as a rule, in cases of favourable course, more rapidly recovers its natural character than after the absorption of pleuritic effusion. I have known the tone scarcely different from that of health in a spot where, three days before, there had been very marked dulness: but such rapid resolution is, unfortunately, very rare; and there are instances, conversely, in which wooden quality and much resistance hold on for a considerable time.

1110. Does retraction of the chest-walls occur in the advanced periods of pneumonia, where no suspicion can exist of the presence of pleuritic effusion? Dr. Stokes teaches the affirmative. M. Woillez maintains, on the contrary, that where contraction occurs in pneumonia, there has always been some effusion into the pleura, and that the process of contraction is identical with that in simple pleurisy. M. Grisolle adopts the same views respecting this question as M. Woillez. In nine cases of *simple* pneumonia, antero-posterior and circular admeasurement failed to detect any diminution of size during the progress of convalescence.

Some years since I observed a case of extensive pneumonia of the left side, in which indisputable depression of the *latero-anterior* part of the chest gradually took place during the progress of recovery. As far as physical and symptomatic evidence can decide the point, there was certainly neither pleural exudation nor liquid effusion in this instance; hence, although, as in Dr. Stokes's cases, there was no *post-mortem* examination to decide the question, I cannot help feeling persuaded that simple pneumonia may entail the alteration of shape which I thus believe I have actually witnessed.

1111. The rhonchus crepitans *redux*, like the true crepitant, suggests the idea of crepitation; but the crepiti constituting it are moister and commonly more suggestive of "bubbling;" they

convey the impression of larger size; are more slowly evolved, rarely, if ever, occurring in abrupt puffs; are comparatively few in number; are more or less dissimilar to each other; somewhat irregular in occurrence; and frequently audible in expiration as well as in inspiration, though more specially appertaining to the latter.

Such are the ordinary characters of the rhonchus co-existing with the resolution of pneumonia. But in a certain number of cases its properties are much more similar to those of true crepitation: it possesses the same dryness, the same minuteness (I have never, however, observed *redux* crepitation of greater delicacy than the primary, as M. Grisolle appears to have done), and co-exists with inspiration only. The observation of these facts, and of the vague manner in which the phrase "*redux* crepitation" is applied to the rhonchi existing in lungs undergoing the resolution of pneumonia, coupled with examinations made for the express elucidation of the point, has long led me to the conclusion that under that phrase are confounded two very different phenomena. These phenomena are a fine bubbling rhonchus, and a true returning primary crepitation. The former is by far the more common, has all the characters of a humid rhonchus, and is, I can scarcely entertain a doubt, produced in the minute bronchial tubes; the latter, which affects the characters of primary crepitation, is probably generated in the same seat and manner as this.*

The immediate cause of the fine bubbling rhonchus attending resolution, is probably the passage of air through fluid contained in the minute bronchi: and this fluid may either be the result of capillary bronchitis, or be merely on its passage from the previously engorged and now œdematous lung. This latter opinion seems calculated to throw some light upon the cause of a circumstance with which auscultators are well acquainted; namely, that the rhonchus of resolution of pneumonia sometimes lasts but a few hours, and at other times persists for weeks.

* It will be observed that the rarity of true *redux* crepitation is in accordance with the theory which localises the primary rhonchus in the parenchymatous exudation [321] it is in truth unlikely that the physical condition of the inter-alveolar plastic exudation should often be singular at the two opposite periods of the malady; and hence improbable that a given phenomenon, depending for its existence on that condition, should frequently occur with identical characters at both these periods. But the thing may, *a priori*, be conceived a possible occurrence; and so we find by observation, that the effect which would follow, did it occur—that is, the re-appearance of the true primary rhonchus—is occasionally met with. On the other hand, were the primary rhonchus produced by bubbling in the interior of the vesicles, there is no obvious reason why the return of true primary crepitation should not be an invariable sequence of resolution.

1112. *Signs of abscess.*—When, instead of the infiltrating form of liquid exudation or suppuration, abscess occurs, the physical signs are of course peculiar. The student should remember that in diagnosing pulmonary abscess, the first point, if possible, to be ascertained is, whether the signs of pneumonia have existed in the organ which is suspected to be the seat of purulent collection. Admitting this to be settled in the affirmative, the special signs of abscess will vary according as the pus has been more or less completely evacuated, or is still retained.

First, in the case of a *pulmonary abscess, of which the contents are more or less completely evacuated*, the diagnosis is grounded generally on the fact of the signs of excavation supervening upon those of pneumonia. The percussion-sound is either dull with marked parietal resistance, or of tubular, amphoric, or cracked-metal quality; the respiration is cavernous, or tubular, accompanied with large-sized, thin, metallic, echoing rhonchus. The vocal resonance may be bronchophonic, pectoriloquous, or null.

Secondly, in the case of *an abscess with its contents retained*, in consequence of want of ready bronchial communication, the signs are, of necessity, extremely obscure. There are none, indeed, of a really distinctive kind. The resistance is marked, the percussion-sound may be toneless or tubular, the respiration tubular, and the vocal resonance strongly bronchophonic. But all this might have existed before the formation of abscess.

1113. Sphacelus of the lung,—one of the very rarest terminations of acute pneumonia,*—would be signified by the signs of a cavity; the expectoration growing, at the same time, profuse, and of peculiar savor.

1114. An oedematous state of the parenchyma may remain long after the resolution of pneumonia.

1115. *Symptoms.* (A) *Prodromata.*—A certain proportion of adults, varying between a sixth and a third of the whole number attacked, suffer from prodromata in the shape of general febrile disturbance, of from one to four days' duration, after the action of the cause, and before any local symptom of the disease makes its appearance. In the majority of cases the invasion is sudden.

1116. (B) *Invasion.*—The invasion of the disease is marked by rigors, followed by pain in the side, short cough, oppressed

* The rarity with which gangrene of the lung originates in acute athenic inflammation is now generally recognised. Of 365 cases of pneumonia analysed by M. Griseolle, not one terminated by gangrene; and of 70 cases in various journals perused by him, 5 only could be considered positive instances of this mode of termination of the acute disease.

breathing, and sometimes cephalalgia and vomiting. Rigors, oftentimes severe, are very rarely deficient: in a large proportion of cases they form *the* phenomenon of invasion; with greater frequency, indeed, than in any affections, except ague, and perhaps puerperal fever. The respiration is often accelerated greatly out of proportion with the pulse, at the very outset,—before any local symptom or sign points to pneumonia.

1117. (c) *Actual disease.*—1. *Local.*—Among the symptoms of the actual disease stands *pain in the side* (29 only of 301 patients escaped it; and in 161 of 182 it appeared within the first twelve hours; Grisolle). This pain, generally seated below the nipple on the affected side, and rarely corresponding precisely in seat with the pneumonia, depending commonly on co-existing pleuritic irritation, in infinitely rare cases springs apparently from the lung substance itself: in the latter case always slight; in the former variable in amount and increased by cough and parietal pressure, and sufficiently difficult of explanation [755].

1118. *Increased frequency of breathing*, to a variable amount, is a constant symptom; occurs within the first few hours; and raises the number of respirations to from 24 up to 80 per minute,—from 30 to 50 being the more usual extremes. The amount of subjective distress varies inexplicably: not uncommonly 30 to 40 respirations per minute may exist without the patient being conscious of particular dyspnoea,—whereas, if they reach 70 to 80, speech is obstructed, and suffocation may appear imminent: but, on the other hand, a man breathing 60 to 70 times in the minute,* may be wholly unconscious of dyspnoea. The frequency of breathing does not depend on any particular seat of the pneumonia, nor even, singularly enough, on its extent,—at least, necessarily. I have known double pneumonia attended with a less number of respirations than inflammation of a limited portion of one lung.

1119. Now the heart's contractions do not increase in frequency in the same proportion as the respiration,—hence the ratio of the two becomes more or less perverted. Thus, for 100 pulsations per minute, there may be 60 respirations (I have seen this)—numbers giving a ratio of 1·7 : 1, instead of 4·5 : 1, that of health. The same perversion exists in those exceptional cases of pneumonia in which the pulse maintains a low frequency throughout; nay, it here seems to attain its maximum possible limit, as I have actually known the pulse beat 56, while the respiration oscillated between

* Styler, U. C. H., Males, vol. x. p. 306.

60 and 70.* In certain cases of asthenic pneumonia, the ratio may fall quite within the limits of health, as 132 : 32, or 4.1 : 1.†

The significance of this perverted pulse-respiration ratio is great; I have found it in several instances, *prove the first sign of asthenic pneumonia, appearing before crepitation or rusty expectoration*; as, *per contra*, a return to, or towards, the healthy standard, may announce resolution some days earlier than the *rhonchus crepitans* *redux*.‡

1120. *Cough and expectoration*.—Cough in the great majority of cases, occurs within the first twelve hours,—moderate in amount, rarely paroxysmal, more severe in double than single pneumonia, and diminishing, occasionally, even ceasing, towards the close in fatal cases. It is accompanied in the majority of instances with *expectoration* of very striking characters,—sanguinolent, or rusty in tint, viscid, semi-transparent, adhering to the vessel, but slightly aerated, passing through various shades of orange, apricot colour, faintly greenish, and lastly becoming white—then opaque and of bronchitic qualities. In some cases the sputa are diffluent, watery, and of dull brown, or even faintly blackish, hue,—resembling liquorice juice, or prune juice,—conditions of evil augury. The red tint of the sputa in the mass of patients comes on during the first forty-eight hours, and when the fourth day has passed, the appearance becomes very unusual; it may last from one to fourteen days. In some rare instances, the sputa continue white throughout; and in yet rarer ones, especially where the pneumonia is central, or of the upper or still more rarely of the lower lobe,§ there is no expectoration. If the expectoration in pneumonia be actually more or less profusely bloody—if there be hæmoptysis, in short—the pneumonia is, according to my experience, tuberculous.

Microscopically the rusty sputum consists of muco-epithelium, blood-disks, exudation-cells, amorphous patches of exudation-matter, oil globules and granular fat sometimes in large quantity. Moulded exudation-casts of the ultimate bronchial tubes, and even of the air-vesicles, studded more or less abundantly with exudation-cells, are sometimes to be seen: but the opinion of Remak as to their importance and constancy seems unfounded. True pus-cells are very rare in the sputa at any period, and never appear in

* Styles, U. C. H., *Males*, vol. x p. 306.

† Sherris, U. C. H., *Males*, vol. xv p. 85.

‡ Craddock, U. C. H., *Males*, *Clin. Lect.*, loc. cit. p. 144. I have observed the same perversion, antecedent by twelve hours to any physical sign, in a case of pyo-hæmic pneumonia following the excision of axillary cancer.

§ McLane, U. C. H., *Males*, vol. xv p. 180.

the rusty sputum, as far as I know. Accidental ingredients, such as biliphaein, are met with in certain diathotic varieties of the disease. Sugar exists in sufficient quantity, sometimes, at the height of the inflammation to be discoverable by Trommer's test: the interference with oxidising processes in the consolidated tissue accounts both for the oil and sugar in the sputa.*

1121. The *expired air* is sensibly colder than natural, especially when the respiration is very frequent; and the quantity of *carbonic acid* expired, as originally shown in the last century by Nysten, falls sensibly below the average [498].

1122. (2.) *General*.—The pyrexia of pneumonia is habitually well marked. The *pulse* may reach 140 to 160 beats per minute, —and in the mass of serious and fatal cases, is of much greater frequency than in those of recovery, generally attaining its maximum frequency by the third or fourth day. I have, however, known pneumonia run its course, both in old persons and in young adults, with a pulse never exceeding 60; but in these individuals the healthy standard has, on recovery, proved even still lower. Unless when very frequent, the pulse is habitually full and resisting: when feeble and small, this sometimes depends on embarrassed circulation, produced by *distension of the right cavities of the heart* with blood. Fulness of the jugular vein occasionally appears under such circumstances,—possibly, sometimes, from actual pressure on the vena cava by the hepatized lung: jugular pulsation is a possible occurrence, and pulsation even of the dorsal veins of the hand has, in rare instances, been seen.

1123. The *blood*, buffed and cupped, is hyperinotic in the highest degree,—the fibrine ranging from 6 to 13 per 1000. There is a peculiar tendency to the formation of solid resistant coagula in the right heart, and in the pulmonary arteries, an obvious source of embarrassed circulation and occasionally actually causing sudden death; but I must express my dissent from the opinion of M. Bonillaud, that their formation is an invariable attendant on hepatization. These coagula rapidly soften centrally; they sometimes contain genuine pus-cells.

The serum occasionally exhibits a milky aspect, from excess of fat.

1124. The temperature of the *skin* rises; its feel often grows, as originally insisted on by Addison, pungently, acridly, burningly

* The freer the use of amylaceous food, the easier is the detection of sugar in the *excreta of pneumonia*, as of all other diseases in which sugar persistently or temporarily impregnates the liquid accretions.

hot, — not more so in the vicinity of the inflamed part than over the rest of the chest. The thermometer may mark 104° , 105° , 106° , in the axilla.*

The peculiar feel of the pyrexial skin gives, as a rule, more efficient help in diagnosis, than mere thermometric rise of temperature: there is in truth nothing distinctive in this. But, exceptionally, great rise in temperature during the onset of a non-localized pyrexia, say to 104° , will justify suspicion of pneumonic outbreak.

In those rare cases,—apyrexial pneumonias,—no rise occurs at all: there are others in which the rise proves slight, transitory, and non-significant.

Sweating, more or less copious, may occur towards the favourable decline of the disease,—and sudamina form in abundance.

1125. The *digestive organs* sympathise. The *tongue* varies in appearance, but does not exhibit the characters attaching to adynamia in sthenic cases: *thirst*, though scarcely in the direct ratio of the fever; *anorexia*; occasionally vomiting; tendency to constipation, or sometimes, especially in fatal cases and towards their close, diarrhoea, more or less profuse; mark the implication of the alimentary canal. *Jaundice* occasionally occurs, on the whole more frequently when the right lung is affected than the left, but with little more frequency when the disease is seated in the lower rather than the upper lobe of that lung. Writers who insist that intercurrent jaundice is limited solely, or almost solely, to pneumonia of the right base, at once ignore the evidence of facts, and strive to support what appears to be a false theory (that of irritation by continuity or contiguity of texture) of the mechanism of pneumonic icterus. They forget, too, that hepatitis itself even is not an active cause of jaundice. The truth seems to be that, when much obstruction occurs in the right cavities of the heart, the clogged state of the vena cava falls back upon the radicles of the hepatic vein; these in their swollen state press upon the minute bile-ducts, and cause stagnation of their contained bile, which is then absorbed into the circulation. I have seen two cases, post-mortem, fully sustaining this view.

* For an attempt to fix by means of the thermometer the relationship of the parenchymatous changes to the pyrexia, the degree of the disease, its form, its stage, the day it has reached, its amount of danger, its improvements, its relapses, the influence of treatment, the occurrence and persistence of complications, the "guarantees of the certainty of recovery," the warning signs of unresolved and lurking disorders, and of sequelæ, the student is referred to the conscientious, if somewhat enthusiastic, volume of Wunderlich. *Temperature in Diseases*, Trans. by W. B. Woodman, M.D. New Syd. Soc., 1871.

1126. The characters of the urine, of ready clinical discovery, may be set down as follows, from the analysis of a considerable number of cases. The specific gravity ranges between 1012 and 1030, the maximum being observed, with reduced proportion of water and considerable excess of urea at the height of the disease, —the minimum, with the converse conditions at the outset and at the period of convalescence. Crystals of uric acid, occasionally urates in abundance, coincide with deep colour, strong urinous odour, and high specific gravity. Mucó-epithelium occurs indifferently at all periods. Convalescence is sometimes coeval with a copious appearance of crystalline triple phosphate, or of oxalate of lime, with or without the former salt: where both are at first associated, the phosphate may disappear in a day or two, the oxalate remaining.* Albumen may be absent from first to last, appear temporarily, or exist in the urine of every twenty-four hours from first observation to convalescence †—always in very small quantity. My observations show that no connection exists between the appearance of albumen and convalescence, as Martin Solon,‡ who first established the frequent occurrence of the symptom (in 22 of 24 cases), long since attempted to prove. Far from this, the congested state of kidney on which it really, as I believe, depends, is likely to be more marked, the graver the amount of obstruction in the right side of the heart; and though unable positively to assert this, I think anything like notable albuminous impregnation is an evil, rather than a favourable sign.

The organic constituents generally range high, the inorganic salts fall below the average. Redtenbacher ascertained that, in particular, the chloride of sodium gradually diminished until hepatisation was established, when no traces of it could be found,—the salt reappearing with resolution of the disease.§ Dr. L. Beale, further, finding an excess of the chloride in the sputa, refers the latter fact to a determination of the salt to the inflamed lung, depending on the activity of morbid cell-development occurring within it.|| Even that taken with the food is retained, instead of being excreted in the ordinary way. With resolution free urinary excretion of chloride returns. It is, however, to be remembered that deficiency of chloride of sodium in the urine is by no means peculiar to pneumonia,—occurring (though to a less serious

* P. Kennedy, U. C. H., Males, vol. viii. p. 70, May, 1849.

† A. Bishop, U. C. H., Males, vol. ii. p. 124, July, 1847.

‡ De l'Albuminurie, 1838.

§ *Zeitschrift der Gesellschaft der Aerzte zu Wien*, 1850.

|| *Med. Chir. Trans.* vol. xxxv. p. 325, 1852.

degree) in plenisy, capillary bronchitis, and acute tuberculization of the lung. And it is yet open to question whether pneumonia be always attended with so-called *achloria*. In a recent instance of acute rheumatism,* the chlorides appeared in full quantity, during the course of an intercurrent attack of pneumonia.†

1127. Among *cerebral symptoms*, the only one of frequent occurrence is cephalalgia; it comes on from the first, as an attendant on the febrile state. Delirium, coma, and convulsions are rare; complete insomnia is seldom observed. The *organs of sense* are not specially affected; epistaxis, however, is sometimes met with.

1128. *Prostration of strength*, as a rule, occurs from the first, and is so positive and so marked, that the fact may be made available in diagnosis; the exceptions are very rare. The *face*, more or less anxious in its expression, is of heightened colour generally, or particularly about the malar bones,—the tint being actually red or tending to lividity,—or pale, sallow, yellowish, earthy-looking.‡ When one malar surface only is red, this has been affirmed to depend rather on the decumbency of the patient, than on the influence of the lung affected: there is, however, nothing unreasonable in the supposition that the innervation of the sympathetic in the face may be modified through excitement of that nerve in the inflamed lung. The state of the *pupil* deserves investigation. The *decumbency* is most commonly dorsal, with inclination to one or the other side. Andral affirms that not one out of fifteen patients lies directly on the affected side.

1129. *Emaciation* rarely reaches the amount noted in other acute diseases of equal or nearly equal danger: whether the non-destruction of fat, consequent on defective respiration, explains this, is matter for enquiry.

1130. *Terminations*.—The anatomical terminations of acute pneumonia are,—by resolution, diffuse suppuration, abscess, gangrene, and chronic induration; the clinical terminations, by recovery, death, and lapse into the chronic state.

1131. *Resolution*, of which the signs have already been systematically set down, occurs at very various periods, and with

* Tennant, U. C. H., *Males*, vol. xvii. p. 1.

† But the influence of rheumatic pyrexia, *per se*, is yet undetermined. It may be that, like the pyrexia of ague and of hectic, it tends to increase the quantity of chloride. Vide S. Ringer, in *Med. Chir. Trans.*, vol. xli. Howitz maintains that the quantity of chlorides in rheumatism depends wholly on the food and not on the condition of the disease (*Schmidt's Jahrbucher*, No. 9, 1837). This idea is generalised by Primavera in regard of all diseases (*Dobell's Reports*, vol. ii. p. 150, 1871).

‡ Dr. Beale suggests that this sallow tint may be due to deficiency of chloride of sodium in the blood. *Loc. cit.* p. 369.

different combinations of those signs. Thus, of 103 convalescents, observed by M. Grisolle, and discharged from hospital between the twentieth and fifty-fifth days of the disease, 37 had no morbid signs, 38 weak respiration, 14 slightly blowing respiration, 11 redux crepitant or "subcrepitant" rhonchus, and 5 deficient expansion with bronchitic rhonchi.

It is most important to observe that the physical signs of resolution, when the entire lung has been affected throughout by idiopathic inflammation, make their appearance first at the apex. If they pursue the contrary course, travelling from below upwards, the existence of tubercle superiorly is to be strongly apprehended.

Absolute fall in the frequency of the pulse and respiration, affecting, however, the latter in excess, whereby the pulse-respiration ratio returns somewhat nearer the natural standard;—diminished heat of skin (which sometimes precedes, sometimes follows, slackening of the pulse), and occasionally more or less marked changes in the urine as already described, are among the most striking general symptoms attending resolution.

What support does the dubious doctrine of crises and critical days receive from the phenomena of pneumonia? Copious perspiration, cutaneous eruptions, hæmorrhages from the nose and kidneys, fetid dejections, and deposits of urates, have been set down as critical occurrences. In respect of critical days, M. Andral refers to 112 cases, of which, it is affirmed, one half terminated on the seventh, fourteenth, or twenty-first days. In 34 cases, collected by M. Grisolle, where resolution occurred between the fourth and twelfth days, the fifth and ninth days are, on the other hand, the only ones exhibiting undue shares (9 and 11) of recoveries; the seventh day contributing only 3, or not quite 9 per 100 of the whole number.*

1132. The symptoms of *diffuse suppuration* are ill-defined and unsatisfactory. Shivering may be completely absent, and dark fluid liquorice-juice expectoration, to which some writers attach much significance, may exist in the stage of red hepatization. The general symptoms become more severe, and of adynamic

* The whole subject of crises and critical days requires re-examination. Traube, who in his careful work (*Ueber Krisen und kritische Tage*,—or B. and F. M. C. Rev., 1863), refuses to admit crises of diseases, but acknowledges in a novel sense that of the fever accompanying them, appears to have struck out an important path of inquiry. This writer settles the question that has puzzled alike schoolmen and clinical observers from time immemorial, as to the relationship between the disappearance of fever and the occurrence of critical discharge, by cutting the Gordian knot, and affirming that sometimes the crisis is the effect, sometimes the cause, of the pyrexia. My own observations have taught me that the pyrexial heat of skin may abruptly fall on any day of the disease indifferently.

character,—dry tongue, sordes on the teeth, pinched features, anxious expression, clammy skin, failure of strength of pulse, wandering delirium, or somnolence, and semi-coma occur. But all this *may* happen in cases where no suppuration has taken place; and as already admitted, there is no positively distinctive physical sign. Hence it follows, that the difficulty of proving the fact of recovery after diffuse suppuration, is extreme; in truth, there is no conclusive evidence of recovery having ever actually occurred in such cases.

1133. There are no positive symptomatic evidences of the formation of *abscess*. The contents may be fetid, from a sloughing condition of the walls. Such a case is readily to be confounded with primary gangrene of the lung. Abscesses may terminate favourably by passing into the state of quiescent cavity; and it is alleged (although they early—sometimes in a week—become lined with a pyogenic, and, eventually, pseudo-mucous membrane) by perfect cicatrization.

The symptoms and signs of *gangrene* of the lung will be separately considered presently, as likewise the subject of *chronic pneumonia*.

1134. Dating *convalescence* from the fall of temperature, and restoration of the pulse-respiration ratio more or less closely to that of health, the process is generally rapid; the recovery of strength, and of such amount of flesh as has been lost, quickly follows. The ex-patient is for a time easily put out of breath, and often suffers from pain in the side, sometimes for many weeks. Percussion-dulness and various forms of morbid respiration gradually, but slowly, wear off. The signs of pulmonary cedema sometime supervene.

1135. M. Macario records two cases of pneumonia, in which, during the period of convalescence, fornication and muscular weakness, commencing in the palms of the hands and soles of the feet, were followed by motor paralysis, perfect in the lower, imperfect in the upper limbs. The intellect was unaffected, and no excitement of the spinal cord observed. Of the real nature of the occurrence nothing was established: one case ended in recovery; the other in death, without *post-mortem* examination.* I entertain no doubt, however, the symptoms depended on venous obstruction in the brain, produced by coagulation. I have seen the same phenomena precisely in anæmic women. Besides, in the convalescence from pneumonia, firm anasarca of a lower extremity

* Bulletin Gén. de Thérapeutique, 1850.

occasionally occurs, evidently depending on local venous obstruction, caused by coagulation of the blood,—and sometimes with, more commonly without, imperfect evidences of phlebitis. I have known this kind of embolic swelling of a limb last perceptibly for months after convalescence.

1136. The frequency of *relapse* has been estimated by M. Briquet at about one-fifth, by M. Grisolle at about one twenty-eighth, of the cases. The experience of this country supports the observation of M. Grisolle as to the rarity of true relapse, announced by fresh rigors, rusty expectoration and crepitation.

1137. *Mortality*.—The mortality caused by pneumonia in Great Britain is very serious. Taking the estimates of two years and a half, as furnishing a very fair average, we may rate the annual mortality in England and Wales at about 18,908,—an amount actually giving this inflammation the third place among fatal diseases. Further, out of 1,000,000 living population, 1201 annually fall victims to pneumonia. In this country, as elsewhere, however, the annual mortality from pneumonia is subject to serious and inexplicable fluctuations,* the disease sometimes becoming quasi-epidemic.

Pneumonia destroys life, in London, much more extensively in the cold than the temperate months. It may be calculated from the invaluable returns supplied in the Registrar General's Twelfth Report, that in the metropolis the deaths in the quarter ending June, averaged 774; in that ending September, 477; in that ending December, 1185; in that ending March, 1250;—for the five years 1845 to 1849. The deaths average 2435 for the six coldest, 1251 for the six warmest months.

In fatal cases, death rarely occurs before the sixth, or after the twentieth, day. In the great majority of cases, the patient perishes from gradual asphyxia; in rare instances from sudden obstruction of breathing through oedema of the glottis. The rapidity of the fatal issue is by no means always proportionate to the amount of pulmonary tissue implicated.

1138. *Prognosis*.—The major influence regulating the prognosis of pneumonia in individual cases is *age*. In new-born infants, and after the age of seventy, the disease is almost always fatal: between the ages of six and twelve, death is the rare exception; between the sixteenth and twentieth years, scarcely one in fourteen of those attacked perishes; while in each succeeding decade up to the seventieth year, the deaths range between one-fifth and one-

* Vide an interesting paper on this subject by Ziemssen, Ed. Med. Journal, 1858.

seventh of those seized. As to sex, the disease, though destroying the male population more extensively than the female, is, relatively to the numbers attacked, more fatal to females: the first of these propositions is based on the Registrar General's Second Report, which gives 1339 male deaths, 1064 female deaths, to 1,000,000 of each sex living; the second on the results carefully obtained in France by MM. Briquet, Grisolle, and others. Season, if we are to trust M. Grisolle's experience, has but slight influence on the fate of those actually seized; of 100 pneumonic patients, very nearly the same number will perish in summer and in winter: this result is rather startling, when compared with that we have just obtained, showing the influence of season in increasing the absolute mortality of pneumonia; but the two are by no means irreconcilable. *Habitual drunkenness* and *weakness of constitution*, are of unfavourable augury. *Traumatic pneumonia* is, *per se*, the least dangerous. Inflammation of *both* lungs is more serious, as matter of experience, than of one,—as also of a large mass, than a small portion, of one lung. The *side affected* in single pneumonia does not appear to exercise any positive influence: but inflammation commencing with the *upper*, appears on the whole, though the evidence is somewhat contradictory, to be more dangerous than that first implicating the *lower*, lobe. Above all, the so-called *epidemic constitution* is of signal importance in estimating the prognosis: at one period recovery is the rule, at another almost the exception.

According to Remak, the earlier the expectoration of fibrinous casts commences, and the more abundant and continuous it is, so much the more certain and speedy will be the cure. In fifty cases observed by him in Schönlein's wards, there were not more than four or five, in which even a partial diminution of the symptoms occurred previously to the appearance of the casts, while in the great majority an amendment was first observed after their occurrence.* But, as already signified [1120], these observations seem to require corroboration.

Although marked acceleration of breathing is an unfavourable sign, it is not, even to the highest degree, of fatal augury: recovery may take place where the respiration has reached 80 per minute. I have, on the other hand, observed cases where an unfortunate issue coincided with a slack rate of breathing throughout.

* Diagnostische und pathogenetische Untersuchungen (Berlin, 1845); or B. and For. Med. Rev., April, 1847.

Diffluent prune-juice sputa are of evil, but not necessarily fatal, significance.

Cases in which the local and general symptoms improve, despite an extension of the inflammation, as proved by physical signs, do not terminate out of proportion unfavourably.

Fall in temperature cannot be accepted unconditionally as evidence of improvement. Its surroundings, more than itself, give it hopeful or evil significance. High temperature may *per contra* be a fatal sign: when death is preceded by nervous symptoms, a rapid final rise to upwards of 109° may take place, according to Wunderlich.

1139. *Sequelæ*.—Pneumonia is very rarely immediately followed by tuberculization of the lung: so rarely that intense predisposition to tubercle must be admitted, when such a consequence occurs. If lungs, already tuberculised, become acutely inflamed, convalescence from the pneumonia often takes place as rapidly, as if the lungs had previously been sound: and no increase in activity of the tuberculous disease necessarily follows. This fortunate course is, however, only observed, at least only habitually observed, where a small extent of lung has been inflamed: if the pneumonia be extensive, rapid breaking-up of tuberculised parts may follow. The anasarca just referred to [1135], sometimes comes on with extraordinary rapidity and great suffering: in one case of the kind, two hours, counting from the moment the pain, which was agonizing, first came on, sufficed to increase by a third the circumference of the limb.

1140. *Diagnosis*.—(a.) The diagnosis of acute pneumonia as a rule is simple. The combination of crepitant rhonchus, dull or tubular percussion-sound, tubular breathing, rusty expectoration, burning heat of skin, and perverted pulse-respiration ratio, is peculiar to itself. No one of these conditions can, however, be held to be pathognomonic of the disease; the greater the number of them associated in any instance, the more certain the diagnosis. Thus, though sputa having all the characters described [1120], are almost peculiar to pneumonia, the naked-eye appearances, more especially, cannot be held to be formally distinctive: for in some cases of mechanical congestion of the lungs, especially from mitral disease, the expectoration may be somewhat viscid, faintly aerated and semi-transparent, and the blood-tint rusty. Again, analogous perversion of the pulse-respiration ratio may exist in hysteria.

(b.) The distinctive marks of capillary bronchitis, of fluid in

the pleura, and of acute phthisis, are included in the accounts of those diseases.

(c.) When pneumonia sets in with adynamic symptoms, it may be impossible to distinguish the case from true typhoid fever, with superadded pneumonia, until the period for the appearance of the specific eruption, having passed with or without result, decides the point.

(d.) *Edema* of the lungs is, except in very rare instances, [324], distinguished by the comparatively large size and bubbling character of its rhonchus, by the absence of tubular breathing, by the deficiency of febrile action, heated skin, and perverted ratio of the pulse and respiration, and by the circumstances under which the disease originates.

(e.) Attention to the character of the different *pseudo-rhonchi* (pleural, mediastinal, and parenchymatous), as elsewhere described, will prevent their being mistaken for true crepitant rhonchus.

1141. *Treatment*.—*Venesection* (a). Pneumonia is an inflammation; hence antiphlogistic remedies, and amongst these blood-letting, must hold the first rank among means calculated to bring it to a favourable issue. Such is one *a priori* view of the proper management of the disease. But if we hesitate to adopt this view, unless sustained by experience, a difficulty the most disheartening meets us at the threshold of the necessary inquiry. We find some men ascribing results the most favourable to venesection pushed to startling extremes, and others tracing an equal or yet greater success to a system of absolute non-abstraction of blood. Lamentable indeed is the spectacle of hostile opinion and vacillating practice afforded by the history of the treatment of pneumonia from the days of Hippocrates to our own. Yet from the experience collected within that lengthened period, inferences may be gathered by the unprejudiced inquirer, guiding to a tolerably sure verdict concerning this still vexed question.

(b). In the first place moderate venesection has been numerically* proved both by Louis and Grisolle, to diminish the mortality and lessen the mean duration of the disease, and also curtail the duration of its prominent symptoms, both subjective and objective,—

* The mass of numerical returns bearing on the general question of bleeding is large: but unfortunately it is worthless. Obviously, when we find some therapeutists returning their deaths as 1 in 90 or as 6 in 30, while on the other hand certain observers plead guilty to a mortality of 33 and even 45 per 100, the conclusion is unavoidable, that either different diseases are referred to, or that errors in diagnosis, unintentional or wilful, have been extensively committed.

the pain in the side, the febrile action, the peculiar expectoration, and the physical signs. Whether venesection possess the power of actually arresting the disease at the very outset, and preventing the occurrence of hepatisation, must be held to be yet scientifically undetermined. If, on the one hand, in the immense majority of cases, it be vain to push bleeding to extremes in the hope of producing any such effect, clinical observation has more than once led me to at least strongly surmise that active congestion may be prevented from reaching the exudation-stage by a well-timed abstraction of blood.

(c) The thermometer indicates a very considerable fall in temperature, as the immediate effect of bleeding, in a certain number of cases. But this reduction of heat seems to obey no fixed rule; nor is there any amount or manner of fall which makes subsequent rise impossible or even very unlikely.

(d) In acute sthenic pneumonia there are few barriers to venesection. Advanced age cannot be set down as an *absolute* preventive; for Morgagni bled nonagenarians who entirely recovered. But, in the mass, aged persons bear bleeding badly, and recover in notably smaller proportion, if bled, than if not bled. It does not appear that either pregnancy or menstruation, provided the indications be otherwise positive, stands in the way of the use of the lancet. I have occasionally bled women labouring under pulmonary inflammation, during the flow of the catamenia, without arresting the discharge: and if such stoppage should occur, cupping over the sacrum, or leeching the perineum, will prevent any ill-consequences.

(e) During certain epidemics, bleeding is very badly borne; and persons of a constitution either originally feeble or shattered by excess, social anxiety, physical privation, or chronic disease, should, of course, be cautiously deprived of any of their, already spanemic or hypinotic, blood. If the disease be of asthenic type, or even if a tendency to adynamia be distinct from the first, blood-letting proves gravely injurious.

(f) Where legitimate, the earlier the bleeding, the better. Louis shows that pneumonic patients, bled within the first four days, recover, *ceteris paribus*, four or five days sooner than those bled at a more advanced period; and Dr. Jackson, the enlightened practitioner of Boston, has proved that by bleeding on the first day, the mean duration, in a mass of cases at the Massachusetts Hospital, was lowered from 14.60 to 11 days.* No period of the

* Putnam's *Louis on Blood-letting* Boston, U. S., 1836

disease is too late for blood-letting, provided the indication be thoroughly and strongly established on general principles. Even the stage of suppuration is by some held not to be a contra-indication, in itself alone, to the use of the lancet; but, although the name of M. Andral appears among those of the supporters of this doctrine, I have the strongest doubts of its correctness. M. Grisolle refers to four patients, bled to ten or twelve ounces, and in whom *post-mortem* examination, the sole positive test, proved the existence of the purulent stage. In all four cases, the fatal issue was obviously hastened, in one almost immediately caused, by the loss of blood.*

(g) No fixed rule can be laid down for the quantity of blood to be drawn; the mean amount of four pounds five ounces, taken from his patients by M. Bouillaud, has been most satisfactorily proved by M. Grisolle to have produced no more favourable immediate results (and of the ultimate effects what may not be feared?) than the abstraction of a mean quantity of two pounds seven ounces from the mass of patients treated by himself and others.† To me I confess there seems something appalling in the bare idea of M. Bouillaud's treatment; and even M. Grisolle's plan looks formidable enough. Slow convalescence is not the worst evil in cases where blood has been too lavishly sacrificed,—especially by repeated venesections. A form of *spanœmia* is sometimes induced, which it may take months, nay, years, to remove. For my own part, while formerly often recommending abstraction of blood, in adult sthenic cases, to the extent of eight or ten ounces, with occasionally re-venesection to the amount of six or eight, I have within the last few years been even more sober than this in the use of the lancet,—a single bleeding of six or eight ounces appearing to me sufficient.

* Sometimes, as we have already seen, a lung apparently in a state of suppuration is in reality infiltrated with softened fibrinous exudation—exudation-cells alone, and no pus-cells, being found with the microscope. This anatomical fact, not generally known, may have some important bearing on the question of bleeding after the stage of red hepatisation has passed. But who shall distinguish, during life, the case of softened exudation from that of suppuration?

† Even in our own country, it was at one time thought by many that bleeding could scarcely be pushed far enough: men were systematically bled to convulsions. It was held theoretically sound to take away blood, the presumed source of the existing evil, to the uttermost point, but it was forgotten, or it was not known, that the increased output of the circulation during hæmorrhagic reaction might make up for the diminished quantity propelled. In those days, too, provided *theory* were satisfied, *facts* were held as matters of no importance. "Dr Gregory, of Edinburgh," reports Dr. Watson, "used to bleed to the verge of convulsion. His colleagues, Dr. Rutherford, seldom went beyond three bleedings, and generally accomplished his object by two. His patients recovered quickly, Dr. Gregory's very slowly." Yet Dr. Gregory continued to cling to his practice, for he had the theory of the hour on his side.

But I desire it to be understood, I by no means deny that larger abstractions of blood might not be beneficial in the robust and stalwart inhabitants of healthy rural districts. My sphere of practice in acute disease has been too purely metropolitan to warrant me in dogmatising concerning the country.

(h) Leeching, or rather cupping, over the affected part, should commonly be employed in addition to general bleeding: in very mild cases it will suffice alone; local abstraction of blood assuages pain much more directly and quickly than venesection. Four to six ounces may, with propriety, be taken by cupping in a case of medium intensity, in addition to the quantity drawn from a vein; all local pain sometimes instantly disappears after the operation.

(i) That bleeding in inflammation generally is infinitely less in vogue than formerly, is a fact known to all. Why has the practice fallen into disrepute? Is it because, as some affirm, the qualities and type of diseases have changed, and asthenia become their dominant element? Obviously not so: for Broussais to his latest breath, and Bouillaud and his adherents, and some exceptional practitioners in our own metropolis, at the present hour, maintain, on the ground of existing qualities and type, that inflammation demands the lancet as pressingly as at any historic period of Medicine. Is it because pathology has improved? Not a whit more: they, who well-nigh drain their patients' veins, know the current pathology quite as familiarly, and as confidently refer to that pathology in their support, as they who dread even the application of a leech. No! we are simply in a period of reaction from the excesses of the Sangrado school. We have learned from our predecessors the evils of *over-bleeding*,—and seem, in my opinion, very much disposed at the present day to learn from ourselves the evils of *under-bleeding*.

1142. Tartarised antimony stands next in importance to venesection in the treatment of sthenic pneumonia,—were I, indeed, henceforth, in the management of this disease, forced to surrender either, on the one hand, venesection, or, on the other, cupping and tartarised antimony, I should not hesitate to relinquish the former. In what manner this important agent produces its beneficial effects on the lung, is matter of the loosest speculation;—that it does produce such effects, is the really important point, and one of which proofs, obtained by scientific observation, abound. There is not any available evidence to show positively whether the effects of antimony on pneumonia are more marked when the mineral is, as is technically said, *tolerated* perfectly or imperfectly, or when it

is not *tolerated* at all. The question could obviously only be decided by numerical comparison; and the number of cases in which complete tolerance is observed (that is, total absence of effects on the stomach and bowels) is relatively very small. Improvement often takes place within eight or ten hours after the medicine has been commenced with, and without any notable effect on the alimentary canal being noticed; whereas recovery also ensues when it acts freely both as an emetic and purgative. Hence it is more as a result of prejudice (for what but prejudices are even plausible *a priori* theories?) than of logical deduction from experience, that, in imitation of Rasori and Laennec, I prescribe antimony in such manner and combinations as are most likely to prevent its disturbing the stomach. The salt should at first be given in doses of half a grain, combined with dilute hydrocyanic acid, paregoric, and tincture of orange-peel, every hour for the first three or four hours,—and the dose then increased, at intervals of two hours, to one grain; in the course of twelve hours the quantity may be raised to two grains,—its repetition made less frequent, say every fourth hour.

1143. The constitutional effect of mercury is by some held to be peculiarly efficacious in the stage of red hepatisation. It is even maintained that when that stage has been reached, calomel is a more valuable medicine than antimony. No scientific demonstration of this view exists. If it were correct, the value of antimony in hospital practice, at least, would be singularly small; for the great majority of persons admitted into hospitals, have some amount of hepatisation, when first seen. Mercurials appear to me to be desirable in those cases of pneumonia only, where, for some cause or other, antimony is inadmissible.

1144. Attended, as it is, with the maximum amount of hyperinosis observed in any affection, pneumonia seems, *a priori*, likely to be controlled by free and rapid administration of alkalis. Half a century ago, Mascagni treated the disease, during a severe epidemic, on this plan, with remarkable success; his follower, Farnese, gave the bicarbonate of potass in quantities varying from a drachm to an ounce daily.

1145. Should adynamia with low temperature appear early, or should the patient's constitution be notably feeble, antiphlogistic remedies are wholly inapplicable. Carbonate of ammonia, with bark, wine, and brandy, then become the staple agents of treatment. The ammonia may be associated with bicarbonate of potass.*

* Farby, U. & H., *Males*, pt. 28, vol. xi., p. 268.

1146. Bouillaud showed many years ago that a system of profuse bleeding might be enforced in typhoid fever without demonstrably destroying life: of 284 cases treated by the *saignées coup sur coup* 40 died, or 14 per 100. Without, I say, demonstrably destroying life; for though Piédagnel lost only 3 per 100 of typhoid cases at the Hôtel-Dieu under a system of *pure expectation*, many other Paris physicians contributed by *their* systems of management a much larger proportional quota to the victims of typhoid fever than Bouillaud.

Conversely, but after a similar fashion, Béhier,* in imitation of Todd, shows that 29 of 36 persons, aged under thirty, may recover from acute sthenic pneumonia after copious libations of brandy. In other words, acute alcoholic poisoning will presumably save all but 19.4 per 100 of young pneumonic patients. But Skoda,* draining not a drop of blood, employing solely "*extractum graminis*," or a few grains of nitre, and in some instances a little corrosive sublimate, lost 3 only of 45 patients, or 6.6 per 100, though their mean age, twenty-five years and nine months, exceeded somewhat that of Béhier's series.

Probably these experiences of the lowering treatment of adynamia, and the stimulant treatment of hypersthenia, simply exemplify the occurrence of recovery, not through, but in spite of, the agencies intended to secure it. Nor does it throw any slur on the memory of a gifted physician to say that, so far as I can learn, the views of Todd changed greatly before the close of his career, and that in point of fact his practice eventually grew liker and liker to that of the mass of his colleagues.

1147. Blisters are not advisable in the earliest periods of pneumonia; it would appear that they have no effect in shortening the mean duration of the disease, and they certainly increase fever and general irritation at the outset of the attack. At its more advanced periods, when pyrexia has been materially diminished, they, on the other hand, relieve pain and dyspnoea, and seem to promote absorption of the infiltrated exudation. They may with advantage be repeated,—care being taken not to apply them too close to the affected part.

1148. Cold applications to the surface, strongly recommended by some, are, I think, to be avoided. Infinitely preferable are relays of warm linseed-meal poultices sprinkled very slightly with mustard.

1149. The ordinary *juvantia* of the antiphlogistic regimen must,

* Balfour's Report, Br. and For. Med. Rev., p. 591, Oct. 1846.

of course, be carefully put in requisition : the bowels, if necessary, should be opened by medicine ; but profuse purgation is, to say the least, absolutely useless.

1150. Complete demonstration of the utility of treatment in pneumonia is found in the fact, that the mortality of the disease steadily increases with each succeeding day it has been allowed to run its course uncontrolled. The statistics of M. Grisolle, referring to the treatment by moderate bleeding and tartar emetic, show, that while the mortality among those seen and treated within the two first days is only one-thirteenth, it rises among those whose treatment does not commence till the eighth day, from one-third to one-half of the whole number. Here, then, is a condition of success or the reverse, which should never be lost sight of in estimating the value of any given mode of treatment. There are certain other circumstances, beyond the control of the physician, which exercise a most indubitable influence on the issue. Among these, the pre-existence of organic disease, and the state of health generally of the individual, hold an important place. But of all collateral conditions, age is the most important : while at the two extremes of life, in the new-born infant and the octogenarian, pneumonia is, as we have seen, almost inevitably fatal ; the mortality between the ages of six and twelve scarcely exceeds two and a half per cent. And if it be true, that between the ages of fifteen and thirty, the deaths equal about six per cent. of those attacked,—suddenly rise to about fourteen per cent. in persons aged between thirty and forty,—and thenceforth steadily increase with each succeeding decade, it becomes manifest, that, when we plume ourselves on the special excellence of a favourite system of medication, we should take count of the ages of our patients. *There are periods of life at which it is next to impossible to save—there are periods of life at which it is not easy, with common prudence, to lose—a sufferer from idiopathic and athenic pneumonia.*

And hence it is, that, in spite of its apparent gravity, pneumonia is a disease which may, and actually has been, therapeutically played with,—and this with seeming impunity to the sufferers, when they had youth on their side. We have just seen the extent to which a series of Skoda's patients escaped death by being left to the devices of Nature.

1151. The value of the treatment of pneumonia by chloroform-inhalation, as practised by Wucherer, Baumgartner, Helbing, Schmidt, and Varrentrapp, must be as yet considered *sub judice*.

Varrentrapp, one of its most earnest advocates, admits his want of perfect faith, for cases of severity were managed on other plans. Had severe cases been included, his mortality would have averaged about 11·5 per cent. in a mass of patients aged thirty,* whose treatment commenced on the fifth day.

I have in a very few instances tried this inhalation as a subsidiary measure, but not with the flattering results described by its originators. Still, relief of cough and of dyspnoea do very certainly temporarily ensue. Caution is requisite: Varrentrapp lost a patient clearly through the effects of the chloroform.

The number of inhalations averaged seventy-four in ten and a half days; the inhalation was not pushed to stupefaction,—the vapour of a drachm only on cotton being allowed to enter the lungs for ten or fifteen minutes; it was repeated every two, three, or four hours.

1152. Should swelling of a limb with venous coagulation [1135] have occurred, careful bandaging, saline douches, dry friction, and shampooing are the means by which, with the aid of time, the annoyance may be got rid of.

VARIETIES OF ACUTE PNEUMONIA.

1153. The varieties of pneumonia may be arranged in the following manner:—

<i>Varieties depending on—</i>		
(a) Topographical seat . . .	{ Unilateral or bilateral.	
(b) Textural seat . . .	{ Upper, lower, central, marginal, hypostatic.	
(c) Amount of subjective symptoms . . .	{ (1) Lobar, lobular; (2) interstitial, interlobular.	
	{ Obvious, latent, terminal.	
(d) Secondary or inter-current origin . .	In new-born infants . . .	{ Hardening of the cellular tissue, thrush.
	From æt. 2 to æt. 16 . .	{ Croup, cancrum oris, enteritis, measles, hooping cough, variola.
	{ In adults	{ Rheumatic fever, puerperal fever, phlebitis, glanders, pyæmia, peri- and endocarditis, typhus, typhoid, febricula, acute diseases of the brain.
		{ Chronic. { Pulmonary tuberculation and cancer, diseases of the heart, cancer of abdominal viscera, diseases of the liver, scurvy, purpura, Bright's disease, &c.

1154. (a) The *topographical seat* of pneumonia, though mainly interesting anatomically, is not devoid of clinical import, as a

* The age of three patients not treated with chloroform, but included here, is not given. Vide "Medical Times," Oct. 1851.

guide to the observer in quest of the physical signs of the disease. Of one thousand four hundred and thirty cases, seven hundred and forty-two were of the right lung, four hundred and twenty-six of the left, and two hundred and sixty-two of both organs. With respect to the cases of bilateral pneumonia, which hold a rather high numerical rank (they furnish 18·3 per 100 of the whole series), it is to be observed that the great majority of them were not so from the outset; in other words, that the implication of the second lung was secondary in point of time. This, indeed, is a matter of no mean importance; for the existence of the sign at one only, or at both sides of the chest, will aid materially (where its intrinsic characters are ill-defined) in distinguishing the true crepitant rhonchus of pneumonia from the fine bubbling of capillary bronchitis. And even with the qualification now mentioned, alone, the frequency of double pneumonia is probably considerably exaggerated in the estimate just given: fine bubbling has often been mistaken for true crepitation, and a bilateral capillary bronchitis put down as a bilateral pneumonia; it is traditionally well known in Paris that even Laennec committed this error. The age of patients, too, must be borne in mind: in the adult, the proportion of bilateral pneumonias does not probably much exceed one in twelve; * it has even been estimated so low as one in seventeen. On the other hand (though, from the long-standing confusion between hepatisation and pulmonary collapse, the precise ratio cannot now be furnished) it is certain the bilateral disease is more common in early infancy and childhood.

In two hundred and sixty-four cases, the upper lobe was affected one hundred and one, the lower one hundred and thirty-three, the middle part thirty, times (Grisolle). Pneumonia commencing about the middle of the lung is rarely primary: it is commonly either a sequence of endo-pericarditis or of blood origin,—a fact of obvious practical signification. The anterior *margin* of one or both lungs is sometimes separately inflamed: I believe that the frequency of this peculiar seat has been exaggerated from confounding mediastinal pseudo-crepitation with true pneumonic rhonchus.

Under the term, *hypostatic* pneumonia, asthenic inflammation occurring in the aged and adynamic, has been included, as well as passive congestion of the lungs [1056]. Clinically it is impossible to draw the line between the two states: fortunately the treatment for both is precisely the same, stimulant and caloric.

* During one scholar year, when I was attending at the Hôtel-Dieu, 48 cases of pneumonia occurred in the wards of M. Chomel: 39 of these were of the right lung; 21 of the left; 4 were bilateral.

1155. (b) *Textural seat.*—(1.)—*Infantile Pneumonia.*—The pneumonia of infancy and early childhood, instead of spreading through a lobe of the lung, pretty frequently limits itself to scattered groups of lobules, the intervening tissue remaining sound: such pneumonia is called *lobular*.* So, too, pneumonia preceding the formation of secondary abscesses or collections of exudation-matter in the lungs, sequential to phlebitis and pyohæmia, commonly assumes this form, no matter what be the age of the individual.

True lobular pneumonia is distinguished in the dead subject from collapse by the physical characters elsewhere [951] enumerated.

1156. The *physical signs* of lobular pneumonia are obscure. Inspection, application of the hand, and mensuration give merely negative results. Percussion, too, does not disclose such an amount of dullness as can be clinically trusted to; which is no more than might be anticipated, when we consider that the nodules of consolidated lung are separated by tissue perfectly permeable. In many cases originally, to all appearance at least, lobular, the percussion-sound may become duller than natural, it is true; but when this is the case, and the opportunity of examining the parts occurs, such extension of the inflammation between the nodules as to reduce the organ, physically speaking, almost to the state of ordinary consolidation, is habitually discovered. The respiration is exaggerated in some points; harsh, bronchial, or even slightly blowing (never tubular, so long as the pneumonia is simply lobular), in the spots probably corresponding to the consolidated nodules. Occasionally a few cracklings of an imperfect crepitant rhonchus may be heard; but it is difficult to distinguish these from the humid rhonchus of fine bronchitis,—a disease almost constantly associated in children with inflammation of the parenchyma.

1157. The signs of *diffuse* pneumonia in the infant scarcely differ from those in the adult. Crepitation, metallic tubular breathing, and dullness under percussion are the essential signs: the child's cry resounds with sniffling and bronchophonic character. The crepitation is of larger size than in the adult.

1158. (II.)—The *interlobular or interstitial areolar tissue* may be the seat of acute suppurative inflammation,† pus occupying the

* Infantile pneumonia, supposed to be the commonest of conditions, until the simple test of Badly and Legendre demonstrated its rarity [951], bids fair now, through exaggeration in the opposite direction, to be expunged from nosological lists. Finckh, for instance, denies that true pneumonic consolidation is to be seen in children under five years of age.

† Carswell's framed drawings. U. C. Museum, No. 57, C. b. 573.

situation that is filled by air in interlobular emphysema. Or this tissue may be infiltrated with fibrinous exudation, which solidifies into induration-matter, and causes considerable contraction of the lung, and sinking in of the side,—an exudation, however, more probably produced by a low congestive than a true inflammatory process. This affection, one of extreme importance, possessing singularly distinctive characters, will be treated of further on, under the title of CIRRHOSIS OF THE LUNG.

1159. (c) *Amount of subjective symptoms.*—Instead of running the ordinary course with marked subjective symptoms, pneumonia may be completely *latent*. The perverted ratio of the pulse and respiration, and the physical signs, are then the sole guides to the detection of the disease: the thermometer is unworthy of trust. Pneumonia occurs in this form solely under circumstances of general physical debility; it is either *senile* or connected with *adynamic* diseases, of which it is an intercurrent phenomenon.

Physically, latent pneumonia is characterised by the rapidity with which it runs into solidification, and with which it involves a great extent of substance.

In managing this form of inflammation, the main attention must be given to the state of the system generally. Venesection I believe should be absolutely avoided,—and abstraction of blood, even locally by cupping, very cautiously ventured on. Dry-cupping is always a measure of utility, and unattended with danger. The early application of blisters is by some observers strongly recommended in this variety of the disease: I have not happened to observe results justifying their confidence.

This is the form of the disease in which medicinal and alcoholic stimuli are urgently demanded from the very first,—and in which the latter may be pushed to an almost unlimited extent.

1160. (d) *Secondary or intercurrent origin.*—It is impossible to exaggerate the importance of pneumonia, when occurring as a *secondary* or *intercurrent* disease: in truth, the majority of cases of fatal pneumonia belong to this class. It is intercurrent pneumonia that commonly kills new-born infants, affected with hardening of the cellular tissue and thrush. From childhood to puberty, croup, cancerum oris, measles, whooping-cough, variola, frequently prove fatal through inflammation of the lungs. Again, we meet it complicating the diseases of the adult,—and, if not at this period so frequently fatal, scarcely less important for the practitioner to watch. Thus it appears in continued fever, phlebitis,

glanders,* puerperal fever, inflammation of the bowels and of the brain or membranes, and in acute rheumatism: among chronic diseases, in pulmonary tubercle, Bright's disease, chronic affections of the liver, not so commonly as might be expected in organic diseases of the heart, and in cancerous affections, not only of the thoracic, but of distant organs.

In the *treatment* of intercurrent pneumonia, we must remember that the inflammatory character of the local malady is modified more or less seriously by the general and diathetic state of the system. It is exceedingly probable, indeed, that various differences exist in the intimate constitution of many of the intercurrent pneumonias,—though at present no absolute proof of the fact can be given. Hence, if antiphlogistic management be proper, as it positively may be in these cases, the state of the system at large should always be allowed full control. This is more especially true in the instance of diathetic diseases, such as rheumatism: it may be that colchicum is a more important remedy than antimony for rheumatic pneumonia. In pneumonia complicating purpura, the treatment, except in regard of blistering and dry-cupping, is wholly that of the blood-disease present.

IV.—CHRONIC PNEUMONIA.

1161. Chronic pneumonia is rare as a sequence of the acute disease; it is rare as a primary disease; it is common as a local attendant on the progress of tubercle, cancer, and other adventitious products in the lung.

1162. Chronic pneumonia presents itself clinically under two different forms.

1163. *A. First form. Anatomical Characters.*—The lung, as a mass, is heavy, its tissue of high specific gravity, solid to the feel, tough, resistant, torn with difficulty, more or less dry, or at most giving out a little frothy pale-buff fluid on pressure, non-granular on section, or even when torn, and variable in colour, dull brown, greyish, dirty whitish. These varieties of tint depend on the relative amounts of permeable blood-vessel, black pigment, induration-matter, and slantingly divided bronchial tube on the surface examined. The natural characters of pulmonary texture are untraceable.

The solidified exudation essentially lies within the air-cells, and sometimes blocks up the ultimate bronchial tubes. But in a minor degree the inter-cell spaces may be infiltrated; just as, conversely,

* Hill, U. C. H. Males, vol. x p. 273.

in cirrhosis of the lung, the interior of the air-cells may suffer on a very limited scale.

There is no tendency to a softening process. Circumscribed gangrene, as originally shown by Carswell, occurs in very rare instances, involving a small extent of substance.

1164. *Symptoms*.—In those cases, wherein acute pneumonia lapses into the chronic disease, the strength and flesh, instead of returning with more or less rapidity, continue to fail; there is habitual, though moderate, dyspnoea; sensations of discomfort and oppression within the chest are almost constantly present; cough, with insignificant catarrhal expectoration, and in the vast majority of cases not attended with any (never, so far as I have seen, productive of well-marked) hemoptysis, also exists.

Thirst and anorexia, with irregular fever, which gradually grows constant, and has its evening-exacerbation, rarely followed, however, by any notable night-perspiration, betoken serious constitutional suffering; while in addition to all this, the loss of flesh may, for a time, almost equal that occurring in the same period in phthisis.

1165. *Physical signs* mark the changes in the lung. The thoracic surface is more or less extensively depressed, according to the area implicated; the chest movements are impaired, especially the costal ones; the antero-posterior diameter and the superficial width of the side diminish. The percussion-sound acquires the definite characters of Type I. (dulness), or Type III. (hardness) sometimes becoming wooden or tubular, with marked parietal resistance. The respiration weak, uneven in quantity, harsh, bronchial, or diffused blowing in the affected parts, is occasionally exaggerated beyond the confines of these. The vocal resonance varies; it may be bronchophonic or null. The vocal fremitus is intensified.

Chronic pneumonia has no rhonchus of its own; but there may be fine bubbling from bronchitis or oedema. In all probability under favouring circumstances, interstitial creaking-sound may be produced by forced inspiration in lung-substance in this condition.

But the auscultatory signs in chronic consolidation may be of a different kind,—in fact, all of them negative; total absence of all healthy or morbid respiration-sounds, of rhonchus, and vocal resonance, the percussion-sound at the time being completely dull. Commonly the persistence of vocal fremitus will distinguish such a case from pleuritic effusion; but even this saving sign may

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* Hill, U. C. H., *Males*, vol. x. p. 273.

induration, will be described further on as one of the group of Tissue-destroying diseases.

V.—ŒDEMA OF THE LUNG.

1169. *Anatomical characters.*—(Edema of the lung is anatomically characterised by infiltration of its texture with a colourless, or in rare instances slightly sanguineous, watery fluid, more or less completely airless; the organ is inelastic, pits under pressure and scarcely crepitates. The texture is unchanged, however; fragments, firm and resistant, sometimes sink instantly in water, after trifling, or without any, pressure,—sometimes float after firm pressure.

A slight amount of pulmonary œdema is pretty frequently found, no matter what may have been the cause of death: clinically this is insignificant.

1170. *Mechanism.*—When of clinical importance, pulmonary œdema is in the immense majority of cases a secondary state, either of passive or mechanical origin. Passive when it forms a part of general dropsy, depending on morbid states of the blood, as in Bright's disease, purpura or scorbutus, or occurs in the course of acute general diseases, such as typhus or typhoid fevers, —passive, too, when it follows as a sequence of congestive conditions of the lung, as after the acute periods of bronchitis and pneumonia, or in the course of chronic bronchitis. On the other hand, it depends on mechanical influence, when traceable to obstructive disease of the orifices of the left side of the heart, or on disease of, or extraneous pressure by tumor or aneurism on, the pulmonary veins.

Hypertrophy of the right ventricle and pulmonary artery are conceivable causes of a sort of active œdema of the lung; but I have not met clinically with œdema of the species.

Section of the par vagum induces, among other effects on the lungs, sero-sanguineous infiltration of their texture; but of the influence of morbid states, dynamic or statical, of the nerve in producing such œdema, nothing is known but by conjecture. The effect in vivisections is probably of passive or paralytic mechanism. Laennec taught that pulmonary œdema may occur as a primary and idiopathic condition, and that the suffocative orthopnoea, which sometimes cuts off children after measles, arises from such œdema.

In cases of general dropsy the external anasarca, as is well known, seems to be rapidly translated in some cases to internal

cavities, especially the peritonæum, more rarely the pleura. I have once or twice known the transference take place essentially to the parenchyma of the lung.

Considering the numerous ways in which pulmonary œdema is speculatively producible, it is of rare occurrence.

1171. *Site*.—(Edema, under whatever conditions generated, is usually either diffused through the lungs, or limited to those parts where the laws of gravitation would naturally direct the fluid. But serosity may accumulate especially at the apices. In a case of emphysema,* carried to so high a point that the anterior edges of the lungs overlapped superiorly, and almost completely covered the heart inferiorly, and in which there were dilated bronchi, bronchial abscesses, and some spots of pulmonary apoplexy, the apices, bearing the marks of the ribs upon them, were loaded with black-coloured fluid, airless and of watery consistence. There was no disease of the mitral orifice or of the right side of the heart: nor was there any obvious obstruction of the pulmonary veins.

1172. *Symptoms*.—Disturbance of respiration from a slight to an intense degree; slight cough; watery, or sometimes rather tenacious, expectoration; sensation of weight and heaviness within the chest; constitute the symptoms—a combination anything but distinctive.

Physical signs.—Nor are the physical signs conclusive. Inspection discloses nothing sufficiently marked to be trusted to; the vocal fremitus may be slightly intensified; the percussion-sound is duller than natural; the parietal resistance increased; the vocal resonance varies in character; the respiration is weak, and harsh, or even blowing, and mingled with fine bubbling rhonchus, or in rare cases with a rhonchus not distinguishable from true crepitation: the fine bubbling rhonchus, when very liquid and well marked, is the most distinctive sign.

1173. *Diagnosis*.—In congestion of the lung, if rhonchus exist, it is drier than in œdema, the expectoration more viscid, and there are no dropsical symptoms. Hydrothorax is unattended with rhonchus, and the dulness, caused by the pleural fluid, changes its seat with the posture of the patient. Pleural pseudo-rhonchus [355], unless care be taken, may be confounded with the bubbling rhonchus of œdema. The rhonchus of capillary bronchitis is rather to be distinguished, it must be confessed, by co-existent evidence of bronchial inflammation, than by its own characters.

* Skinner, U. C. H., *Males*, vol. ix. p. 97, the right lung weighed 42½ oz., the left, 37½ oz.; also H. D., U. C. H., *Males*, vol. x. p. 286, pneumonia sequential to phlebitis and glanders.

Treatment.—Edema, occurring after pneumonia, furnishes an indication for the use of general tonics. If it form a part of general dropsy, it is mainly to be relieved by means calculated to lessen the latter; still dry-cupping, and a succession of flying blisters to the chest, sometimes exercise a distinctly beneficial local effect.

VI.—GANGRENE OF THE LUNG.

1174. *Anatomical characters.*—Laennec described two forms of gangrene of the lung, the diffused and the circumscribed: the tissue may besides sphacelate in patches or in nodules, embracing a greater or less number of lobules. Of sixty-eight cases, sixty-two are represented to have been of the circumscribed, six of the diffused form.*

(a.) In the *diffused form* there is no evidence of limitation, either by exudation-matter or otherwise, of the gangrenous process.

(b.) In the *circumscribed form*, the sphacelated parts are surrounded by tissue infiltrated by exudation-matter of low plastic type. In both forms excavation occurs: in both, though more readily in the former, perforation of the pleura, of the œsophagus, and even of the diaphragm may ensue; fatal pneumo-hydrothorax may thus be caused. Or both pleural layers, having been previously agglutinated, may be perforated, and the gangrenous ichor conveyed beneath the skin, subcutaneous emphysema following,—a series of events, be it understood, of singular rarity. Hemorrhage, either into the bronchi or pleura, profuse enough to cause instant death, has sometimes occurred from perforation of a vessel; but this is rare, inasmuch as both arteries and veins are commonly plugged with conglua, not only in, but on the confines of, the mortified tissue. The bronchi are cut abruptly across by the sloughing process. An observation by Schroeder van der Kolk† proves the pulmonary lymphatics and the bronchial glands may become more or less gorged with gangrenous fluid, after the fashion of purulent matter, making its way from abscesses in the lung to the lymphatic vessels.

Pulmonary gangrene is so commonly fatal, and fatal in so short a period, that opportunities rarely occur of tracing the changes undergone by the excavations it effects. There is evidence, however, to show that a cavity of the sort may eventually become lined with a vascularised pyogenic, or pseudo-mucous, membrane,

* *Dat. de Médecine*, t. xxii

† *Obs. Anat. Path.*, t. i.

secreting a fluid wholly free from gangrenous odour. In a case that has been under my observation for a considerable period, and which I believe to be of this kind, the sputa temporarily acquire a putrid smell from time to time,—but whether from mere alteration in quality of the secretion, or from patchy sphacelation of the surface of the excavation, is of course doubtful.

A tendency to cicatrise is in very rare instances exhibited by these cavities: but of actually complete closure I have met with no recorded example. A case described by Dr. Gerhard shows that nine years after the formation of a gangrenous excavation, closure may not be effected.

Cruveilhier describes an odourless variety of gangrene: the texture falls into shreds: no smell is observed either during life or after death. This condition must, to say the least, be rare.

(c) The diffused and circumscribed forms are generally limited to a single spot; *nodular* sphacelus, like pyohæmic abscesses, frequently affects many together. The periphery of the lungs seems especially to suffer from the latter, the postero-inferior and central parts from the former. The right lung is more commonly affected with diffused gangrene; both organs are implicated, when the disease is nodular, and in very rare cases when *diffuse*.

1175. Pulmonary gangrene is either solitary, or associated with similar change in various parts. The former is more common in the adult; the latter in infancy. In certain hæmic diseases, too, several parts or tissues suffer, coætaneously or consecutively.

1176. *Antecedents*.—The conditions, under which gangrene of the lung occurs, may be thrown into tabular form, as follows:—

Gangrene of Lung produced by—

I.	Pulmonary diseases . . .	}	Pneumonia, acute and chronic; tubercularisation; cancer; hæmorrhage, nodular and diffuse, hydatids; contracting pleural exudation-matter.
II.	Other thoracic diseases . . .	}	Cardiac: acute endocarditis of the right heart.
			Mediastinal: tumor.
			Aortic: aneurism.
III.	Hæmic diseases, produced by	}	Animal venoms; stings of certain insects.
			Morbid poisons { Glanders, exanthemata; typhoid fever, purpura; seury; pyohæmia, gangræna, septicæmia.
			Heteræmia: poisonous gases, mercurialism.
IV.	Perverted innervation of the lungs . . .	}	Epilepsy; insanity; organic cerebral disease.
V.	Traumatic		

A few words of comment on each of these varieties seem called for.

1177. (I.)—The rarity with which acute pneumonia eventuates in gangrene, has already been fully insisted upon; where such termination does occur, it may be immediately determined by excessive violence of the inflammation, or by obstruction, from extrinsic pressure, of nutrient vessels; under either circumstances a depraved state of the blood is, with general adynamia, probably necessary as a prior condition. In the case of chronic pneumonia also, some such favouring condition of the blood is in all probability essential. In rare instances the vascular obstruction caused by the progress of tuberculisation and of cancer, by copious infiltration of blood, and the pressure of a hydatid sac, have all been productive of local gangrene. As a very rare occurrence the tight embrace of a portion of lung, by contracting pleural lymph, has led to the gangrenous destruction of the enclosed part. In all such cases, the nutritive processes are probably impeded by pressure on local nerves.*

But by the obstruction of what vessels is the failure of nutrition brought about? Carswell held, by that of the pulmonary artery. Of the embolic obstruction of its contiguous branches, which he has figured, and which may be often seen on an extensive scale, there can be no doubt. But two objections may be urged. First, there is no certainty that such coagula were not sequential, instead of being antecedent, to the gangrene. Secondly, physiologists assign the nutritive quality especially to the bronchial arteries; while the blood of the pulmonary artery can only nourish, it is held, after oxygenation in the capillaries and within a limited area: now the state of the bronchial arteries in gangrene has, as yet, been insufficiently examined [1178]. Possibly, too, the current physiology of lung-nutrition will by-and-by be remodelled.

1178. (II.) May embolic obstruction of *minute* branches of the pulmonary artery, from circulation of the products of endocarditis of the right heart, cause patches of gangrene in the lung? All I know on the matter is this. In a child, cut off by endo-pericarditis affecting both sides of the heart, and combined with central pneumonia of the left lung, there were three or four pea-like spots in the inflamed tissue distinctly gangrenous: the condition generally of the child was not favourable to gangrene; and it seemed

* Nervous activity is so important an element in nutrition, that, as we know, some surgeons have imagined that nutritious growths might be eradicated by section of the nerves supplying the locality in which they vegetate.

possible that plastic products, or minute fibrinous concretions, from the endocardium might have plugged the capillary vessels. Such facts, if not otherwise explicable, would tend to prove that the nutrition of the lung is really in part effected by the pulmonary artery: they would also corroborate Dr. J. Taylor's views on the mechanical production of pneumonia by endocarditic secretions. On the other hand, the nutritive importance of the bronchial arteries seems proved by the occurrence of pulmonary gangrene (as originally observed, I believe, by Dr. Macdonnell of Dublin) from pressure of a tumor, or aneurismal sac, on those vessels.

1179. (III.) Carswell figures gangrene of the lung, associated with that of the lip, ensuing on the bite of an insect. In children gangrene of the lung has particularly been noticed after measles, scarlatina, and variola, commonly associated with cancrum oris; so, too, in the course of Typhoid fever, purpura, and scurvy; in rare cases of glanders; in the purulent, and in the gangrenous * diathesis, the lung sphacelates in a certain proportion of cases. Poisoning of the blood by inhalation of the gases evolved in animal putrefaction, seems to cause pulmonary gangrene in some persons. The slow deterioration of the vital fluid, worked out by habits of debauchery and by privation, lays the ground-work of gangrene in many instances, if, indeed, it does not unassisted directly produce it.† In all cases of this class there is a tendency to passive congestions and hæmorrhagic effusion.

1180. (IV.) The occurrence of gangrene of the lung has been noticed by many persons as a dependence on cerebral diseases, both structural and dynamic: among the latter mania, dementia, and melancholia may be its forerunners. Of the tolerably frequent concurrence of the two states, there can be no doubt: the sphacelus seems fairly explicable by deficient or perverted nervous influence, just as the local gangrene, which sometimes occurs in a hemiplegic side;‡ and at all events this seems a more likely explanation than that of Trousseau, who, in the case of lunatics, ascribed the gangrene to starvation.

Cruveilhier connects gangrene of the lung with epilepsy; more modern observers § do not recognise the connection, and it has certainly never occurred to me to witness it.

* A diathesis which, though not generally recognised, is just as real as the purulent, and for which the name *gangrenia* might be adopted.

† In Magnus Huss's work on Chronic Alcoholism, however, I do not find gangrene of the lung set down among the effects of slow alcoholic poisoning.

‡ Author's Clin. Lect., "Lancet," loc. cit. p. 281. 1849.

§ E. g., Reynolds on Epilepsy. 1861.

1181. (V.) In those rare instances where the lung has mortified after external injury to the chest, some favouring condition of the blood in all probability pre-existed.

1182. *Influence of age.*—Sphacelation of the lung occurs at all periods of life; the subjoined table, constructed from his own observations by M. Ernest Boudet,* furnishes the most trustworthy information I know of on this point, as well as upon the frequency of the disease, and, indeed, of spontaneous gangrene in general.

AGE.	Numbers of post-mortem examinations.	Cases of gangrene of the lung.	Ratio of cases of gangrene to post-mortems.	Cases of various spontaneous gangrenæ.	Total cases of gangrenæ.	Ratio of cases of gangrene to post-mortems.
Children . . .	135	5	1:27	9	14	1:9
Adults . . .	156	2	1:78	4	6	1:27
Aged persons .	220	2	1:110	7	9	1:24
	511	9		20	29	

1183. *Symptoms.*—The symptoms in the *diffused* form are great general prostration, oppressed breathing, profuse expectoration, frothy and purulent-looking, of gangrenous odour, with a small, feeble, and very frequent pulse, and all the general appearances of intense adynamia. The power to expectorate is soon lost, and death occurs directly from suffocation.

1184. The course of *circumscribed* gangrene is somewhat different. At first the evidences of affection of the lung are commonly extremely obscure; the signs of pulmonary congestion exist, coupled with an amount of prostration quite out of proportion with the extent of local disease. The expectoration mucopurulent, rarely bloody in adults, frequently so in infants and children (if they expectorate at all), acquires, the moment perforative communication is established between the bronchial tubes and the gangrenous tissue, properties more or less strongly characteristic of the disease. It is of dirty-greenish, yellowish-brown, or ash-gray colour; very liquid; and exhales an odour distinctly gangrenous, or resembling that of wet mortar, or *sui generis* but painfully foetid. In the adult the breath commonly possesses the same fœtor, but this may not be constant: the expired air may be completely free for some minutes at a time from disagreeable smell; when suddenly, without cough or any other apparent cause,

* Archives de Méd., Sept. 1843.

it becomes intolerably fœtid.* Possibly temporary plugging of the bronchi communicating with the mortified tissue may account for the absence of odour. In children, fœtor of the breath is less common than in adults,—occurring in scarcely a third of those affected.

1185. *Physical signs.*—The physical signs are those of consolidation followed by the evidences of breaking up of tissue and eventually of excavation. There is no special character in the signs of any one of these conditions indicating the nature of the disorganising process. The signs of pneumonia may precede, and those of bronchitis accompany, the evidences of giving way of tissue.

1186. *Terminations.*—The terminations of circumscribed gangrene are by death or recovery. Death may occur rapidly by collapse, or sometimes by hæmoptysis or hæmothorax. Or the fatal event may take place slowly: abundant purulent fœtid expectoration, hectic fever, night sweats, emaciation, wear out the patient; and, after protracted suffering of weeks, or even months, death ensues. In cases of recovery (unfortunately a small minority), the discharge loses its fœtor, diminishes in quantity, and becomes simply mucous; the hectic fever ceases, the appetite returns, and a complete rally is gradually accomplished. The physical signs of local consolidation, deficient breathing-action, and sometimes of excavation, remain.

1187. *Diagnosis.*—The diagnosis of gangrene of the lung turns upon the peculiar fœtor of the breath and expectoration, coupled with the physical signs of softening and excavation of the pulmonary substance, ensuing upon those of sub-acute adynamic pneumonia, or upon those of congestion of the lung arising in the course of the various morbid states already enumerated. But there are sources of fallacy of two kinds: (a) there may be the extremest fœtor and profuse greenish sero-purulent expectoration, and yet no true gangrenous cavity formed; and (b) there may be a gangrenous cavity without the characteristic conditions of the breath and sputa.

(a) In the first class of cases appear examples of acute added to chronic bronchitis, with or without dilatation of the tubes, where the breath and sputa acquire an intensely fœtid odour, not distinguishable from that of gangrene, without any evidence of excavation,—where recovery takes place, the fœtor being merely temporary, and where the most plausible explanation of the facts is,

* Hayes, U. C. H., Males, vol. vi. p. 82.

that sloughing of the mucous membrane has occurred within the tubes on a minute or even microscopical scale. I have no proof of this view, however, to offer in the form of *post-mortem* examination: and, as already admitted, the factor might depend on putrescence of the bronchial secretion itself [392]. Again, the breath and sputa sometimes acquire gangrenous odour, in cases of broncho-pleural fistula with empyema, where changes in the pleural sac are the real causes of the factor. I have even known the expectoration acquire that odour, in cases of non-communicating empyema, apparently from chemico-vital changes in the pleural cavity,—a fact assimilable to that, familiar to surgeons, of the stercoraceous odour sometimes acquired by the contents of abdominal abscesses without intestinal communication. In both cases transudation of foetid gas, through softened and rarefied tissue of low vital resistance, probably occurs.

But that a combination of circumstances much more puzzling may occur is shown by the following case:—A man, affected with pleuro-pneumonia of the right inferior lobe, recovers slowly from this; but during the progress of convalescence, has hæmoptysis followed by copious frothy expectoration, of factor so intense as to affect the atmosphere of a large part of the ward. At the same time the entire class of hollow signs, which, as already described [746], sometimes arise during the convalescent period of pleurisy, set in. Were these conditions to be looked on as the result of gangrenous excavation in lung-substance, impaired in nutrition by the past pleuro-pneumonia; or as the effects of foetid bronchitis accidentally co-existing with the special physical state that gives rise to pseudo-cavernous signs, no cavity actually existing? The issue of the case argued in the latter direction, as the man left the hospital in fair general health, and free from all physical signs, except those commonly denoting hard consolidation.*

Further, even the positive signs of cavity in the lung *plus* the factor, do not prove that the excavation is of essentially and primarily gangrenous nature. It may be tuberculous or it may be purulent. I have now seen some half-dozen cases of phthisis, in which the special factor occurred incidentally in connection with tuberculous cavities already formed. In one of these instances (Consumption Hospital, Chelsea), the expectoration of a foetid pea-like mass, distinctly possessing microscopically, and even to the naked eye, the characters of pulmonary tissue, put a term to

* Hellen, C. C. H., *Males*, vol. xv, xvi.

the gangrenous discharge,—a fact which I hold to be proof positive that a minute sphacelated spot may impress the characteristic factor upon the expectoration and breath, quite as effectually as gangrene of extensive area. A tuberculous cavity, thus locally gangrenous, is very difficult to distinguish from true gangrene of the lung, if the patient be seen for the first time when that change has occurred, and if the history of the case be imperfect. The seat of the cavity at the apex, and the existing signs of induration at the other upper lobe, once guided me successfully to the diagnosis in a case of this kind; but I am far from thinking the observer would always be justified in an absolute affirmation on such data. A fetid abscess is generally distinguishable from true gangrene, not by the amount of factor, which may be just as great from local sloughing of the walls of the abscess, but by the fact that the signs of excavation precede the occurrence of fetor in the case of abscess, follow it in that of true gangrene.*

(b) The second variety of case, where real gangrene occurs without perceptible fetor, is rare, especially in the adult. In children a guide to the diagnosis of an excavation thus formed, is sometimes found in hæmoptysis; for, singularly enough, while tubercle scarcely ever causes hæmoptysis in childhood, gangrene is at that period of life frequently attended with the symptom.

1188. *Intermittent gangrene*.—Gangrene of the lung-substance, or of induration-matter infiltrating it, may run a chronic intermittent course. At least, I have seen a case in which fetid gangrenous expectoration continued with intermissions for months, without much attendant constitutional suffering, but with gradual development of the signs of excavation in a spot where, I was assured, the existence of a gangrenous cavity had been affirmed by a practised observer some time before, but of which no positive evidence remained, when I first became acquainted with the patient. Had accumulation of induration-matter taken place here, and subsequently slowly sloughed away?

1189. The condition referred to a moment since as connected with endocarditis [1178] may be considered an example of *nodular gangrene*; I have also seen it in one case of so-called secondary

* In a case which long since fell under my observation (Dr. Hayes, U. C. R., *Medex*, vol. vi. p. 22, 1851), there were occasionally and abundantly discharges of almost pure pus, alternating with the more or less fetid sloughy gangrenous expectoration, that had not before proceeded by some days' stage, one of softening and exudation, I should have been disposed to regard the case as one of fetid abscess, especially burning, and not of gangrene; unfortunately permission to examine the body could not be obtained.

abscesses; only a certain number of the nodules, and only the central part of these, were actually sloughy.

1190. *Prognosis.*—The prognosis of gangrene of the lung cannot be held to be absolutely fatal. Recovery has been calculated to occur in one-twelfth of cases: this, however, I regard as altogether too high an estimate of the favourable chances, unless it be understood to include the most trivial cases, as, for instance, partial sloughing of the walls of a cavity. It must be remembered that the characteristic factor may be impressed on the sputa, either independently of demonstrable loss of substance, or by the merest fragment of mortified tissue.

1191. *Treatment.*—In the treatment of gangrene of the lung, the chief reliance has hitherto been placed, in the acute state, in stimulants and tonics. The sesqui-carbonate of ammonia, opium, and camphor, in various combinations with bark, or quinine, given in full and repeated doses, are held to afford the patient the best chances of recovery. The effect on the powers of the system generally, often produced by the *first few doses*, is really extraordinary.

The remarkable effects of chlorate of potass in gangrene of the mouth entitle this salt to a trial, where the lungs suffer; the effects of yeast, in frequently repeated doses of an ounce, also deserve investigation. I should be disposed to confide more in either of these agents than in ammonia, the *permanently* beneficial effects of which I have never, I confess, seen demonstrated. Skoda strongly recommends the following plan of treatment: the essence of turpentine is poured upon boiling water, and the patient directed to inhale the vapour for fifteen minutes every two hours, —sulphate of quinine is at the same time administered. Two cases of recovery are given; but the narratives do not carry conviction with them.* To my mind the recovery seems to have been so easily accomplished, that the cases must have been of the kind a moment since [1190] referred to. The utility of turpentine has, however, met with a strong advocate in the person of Dr. W. Begbie, who believes its action to be "stimulant, antiseptic, almost specific," and gives it in half-drachm doses every second or third hour for days together.

The only local measures advisable, under ordinary circumstances, are dry-cupping and counter-irritation by blistering or otherwise; and these only when the disease appears, in the main, at least, of local origin. If, however, the evidences of acute secondary

* Wiener Zeitschrift, 1853.

pneumonia, produced by the irritative action of the sloughed lung, are conclusive, and the system generally has rallied, a few ounces of blood, it has been held, might be cautiously abstracted by leeches or cupping, from the affected side: positive indications for this practice must, however, vary rarely arise; they have never done so within my own experience.

In cases lapsing into the chronic state, the mineral acids and quinine become the main remedies; of the former, the nitro-muriatic is probably the best.

Fœtor should be corrected by chlorinated mouth-washes, or by fluids containing creasote in suspension, or by Condy's solution of the permanganate of potash. The chloride of zinc may be used for this purpose in a state of extreme dilution; three grains to eight ounces of water. Inhalation of tar vapour, of creasote, of chlorine, or better of carbolic acid, should be had recourse to, not only as corrective of fœtor, but as tending, in all probability, by their direct chemical action on the sphacelated tissue, to control septic changes within the lung, and so lessen the local irritation, and constitutional depression.

The diet should be nutritious and digestible: strong beef-ten, thickened with isinglass or prepared gelatine, finely-pounded meat, eggs beaten up with small quantities of brandy, milk, &c., may be given as frequently as the digestive powers of the patient appear to permit. Good porter in moderation is an advisable beverage. If the adynamia be marked, wine or brandy must be freely administered.

VII.—PULMONARY HÆMORRHAGE.

1192. Under this head may be included all cases of extravasation of blood, either from the mucous membrane, or other actual tissue of the bronchial tubes; or from the proper structure of the lung itself. Pulmonary hæmorrhage is, accordingly, either bronchial or parenchymatous.

A.—BRONCHIAL HÆMORRHAGE.

1193. It is generally stated in systematic works, that bronchial hæmorrhage is extremely frequent; but, if the term be understood strictly in the sense above given it, I cannot help believing that it is of great rarity. Setting aside those instances—mere curiosities from their singularity—in which ulcers in the bronchial tubes, or plastic bronchitis, furnish the blood of hæmoptysis, I have never yet seen a case where blood, *discharged in any quantity during life*,

either seemed from the nature of the case clinically, or was proved, on inspection of the bronchial tubes, to have come from their substance by molecular ruptures, or by exhalation.* True, there is no *a priori* reason why blood should not ooze from the bronchial mucous membrane, as we know it does, as we actually sometimes see it do, from the mucous membrane of the lips, mouth, fauces, or pharynx: but, on the one hand, the evidences of the occurrence are wanting; and on the other, it is found in the great majority of cases (there are some in which it is impossible to form an opinion on the point), that, when blood in any quantity has made its way into the bronchial tubes, the actual pulmonary structures themselves are the sources of supply.† In cases of diseased heart attended with hæmoptysis during life, there may always, as far as I have examined, be found more or less marked evidence that the parenchyma of the lung, and not the mucous membrane, has given way molecularly: the evidence I refer to, is the presence of dark blood-points here and there in the pulmonary tissue—a sort of embryo pulmonary apoplexy. While, on the other hand, I have often found the finer tubes, as far as they can be followed with a scissors, free from undue vascularity or marks of interstitial saturation with blood after hæmoptysis,—a fact the more remarkable, because the larger trunks are occasionally, in such cases, very evidently imbibed with that fluid.

Ecchymoses and petechiæ of the bronchial walls occur in scurvy and purpura; and under these circumstances any probable escape of blood on a small scale into the interior of the tubes actually takes place.

The doctrine of the bronchial origin of hæmoptysis in general has, however, found recent advocates, especially in Germany, who maintain the blood is really furnished by fragile vessels in the mucous membrane. But I cannot discover that any of the number has ever had the “ocular proof” of the correctness of this view.

1194. When blood is furnished by the bronchial tubes, hæmoptysis is its symptom, and thin bubbling abundant liquid rhonchus in the bronchi its physical sign. It does not appear to stagnate

* The escape of blood through the capillary walls, which had for years been thought to be a physical impossibility, has been proved by Cohnhe in *Virchow's Archiv* Bd. 41, p. 229) to be a very fact. he saw the red corpuscles make their way through sound walls.

† I exclude cases where, in the violent efforts of bronchitic cough, streaks of blood, or discs only microscopically visible, appear in the sputa. It is vain to argue in one direction or the other as to the source of these.

sufficiently within the tubes, when of this origin, to alter the percussion-sound.

B.—PARENCHYMATOUS HÆMORRHAGE.

1195. Hæmorrhage springing from the actual parenchyma, occurs (a) with, or (b) without, recognised anatomical characters.

1196. (a) In the first class of cases, we meet with the nodular and the uncircumscribed pulmonary apoplexy of Laennec, petechial, and, lastly, interlobular hæmorrhage,—an example of which hitherto undescribed form I once observed in a new-born infant. No one of these anatomical states is necessarily productive of, or connected with, hæmoptysis.*

(b) On the other hand, there is no established morbid anatomy of the most frequent variety of hæmoptysis, that depending on the process of tuberculisation. Molecular ruptures of the capillary vessels of the parenchyma, enclosed within softening tubercular infiltrations, are doubtless the cause of the discharge of blood in phthisis, except in those cases where a vessel of some size undergoes breakage: but absolute demonstration of the fact is still a desideratum. Even the recent admirable essay of Rasmussen† gives no positive information on this point, while, as we shall by-and-by see, most explicit on the mechanism of rupture of good-sized vessels.

1197. (a) *Nodular apoplexy*.—In this, the circumscribed variety, the blood, contained in the air-cells, forms sharply-defined, rounded, nodules, from half an inch to four inches in diameter, excessively firm to the feel, and raising the pleural surface, if situated close to this. On section these nodules are of very dark red venous hue; slightly, or not at all granular,—in truth homogeneous-looking, except that in rare instances clotted blood in small quantity may be found in the centre,—in these latter cases only is blood expressible in any quantity. They are commonly seated rather in the lower and posterior parts of the organ than elsewhere; vary in number from one or two, to some twelve or fifteen, five or six being about the average, and in the great majority of cases affect both lungs, though in different degrees. Each accumulation is

* It has been shown, indeed, by Dr. Watson, that nodular apoplexy may sometimes be an effect of certain conditions, producing discharge of blood through the mouth, instead of being the cause of the latter. In a man dying from hæmorrhage from the lingual artery, several apoplectic nodules were found, evidently formed of blood, which had trickled downwards from the mouth through the windpipe, and accumulated in the air-cells.

† On Hæmoptysis, trans. from Danish, by W. D. Moore, M.D., Ed. Med. Journal, Nov. 1868.

bounded by tissue, either quite natural, or slightly darkened by blood, apparently imbibed from the periphery of the nodule.

The nature of the changes set up in the extravasated blood has been pretty fully ascertained; the time required for their accomplishment seems, as in the case of other interstitial hæmorrhages, to vary widely. The outline of the nodule grows less sharply defined; the tint lightens, by passing into brownish, and eventually yellowish red; the lung-structure reappears, as absorption advances; the blood-vessels and bronchi, at first impermeable, allow water and air to pass. The seat of old hæmorrhage remains permanently, though but slightly, tough. In very rare instances a firm, buff-coloured hæmatoma marks the locality of past extravasation.

In yet rarer instances suppuration or gangrene occurs. It is said the effused blood sometimes becomes surrounded with a cyst; and also that pseudo-connective tissue may form within it. I have not happened to meet with either condition.

As to the vessels furnishing the blood:—clots have been found both in the pulmonary artery and veins: it is probable the necessary molecular ruptures occur in the intervening capillaries. Whether the bronchial arteries ever thus give way, remains undetermined. The plugging of the pulmonary artery may extend to branches of good calibre.

The adjoining texture is sometimes inflamed,—the inflammation being coetaneous, or consecutive,—neither preparatory nor even precursory.

1198. (β) *Uncircumscribed apoplexy*.—In the diffuse variety the pulmonary texture is torn: blood infiltrates the inter-vesicular tissue; the pleura may undergo rupture, and instantaneous death follow from the combined loss of blood and mechanical obstruction to breathing. Encephaloid cancer sometimes furnishes the blood in this variety. Whatever be its immediate cause, the variety itself may be pronounced to be decidedly rare.

1199. (γ) *Interlobular hæmorrhage*.—An infant, born to all appearance healthy, breathed well for two hours, without exhibiting discoloration of the skin, or other morbid appearance. Sudden dyspnoea then came on; the accoucheur, being still in the house, ran up-stairs; on his arrival the infant was dead. On *post-mortem* examination I found the lungs gorged with blood, except at the anterior border; between the lobes and lobules lay dark clotted blood in considerable quantity. There was much vesicular emphysema with subpleural air-sacculi, and air appeared in some points between the lobules.

1200. (3) *Peteckial hæmorrhage* occurs in the lung-substance in purpura, scurvy and hæmorrhagic exanthemata.

1201. *Antecedent conditions.*—Pulmonary apoplexy, in the nodular form, is almost invariably an effect of disease of the heart, especially of the mitral orifice: for my own part I have scarcely ever seen it, except in cases of mitral disease. Still dilatation, with or without hypertrophy of the left side of the heart, may produce it. In a case of this class the mitral orifice, almost circular in shape and gaping, readily admitted the points of the thumb and four fingers of a medium-sized hand: the valve and cords were texturally sound. I supposed the valve might not have been large enough to close the dilated orifice; but found that on tying the aorta, and projecting a column of water into the ventricle, through the opening made by cutting away the apex of the heart, none of the water made its way into the auricle. Hence there had been no mitral regurgitation, yet there was slight pulmonary apoplexy.*

Nodular apoplexy would appear in certain very rare instances to be independent of heart disease, and to originate in a diseased state of the pulmonary vessels and parenchyma. Of diffuse hæmorrhage few examples have fallen under my notice: cancerous disease of the lung, or injury to the chest, were the immediate causes.

1202. *Emphysema of the lung*, as its anatomy would prepare us to expect, antagonises pulmonary hæmorrhage of all kinds. Nodular apoplexy seems incompatible, certainly is not met in association, with active tuberculisation.

1203. *Symptoms.*—The symptoms of pulmonary apoplexy are exceedingly difficult to specify, because they are mixed up with those of pre-existing disease in the heart, and of disturbance, secondary to this, in the lungs. Dyspnoea, tightness, and dull pain in the chest, all exist independently of such apoplexy in mitral disease; they, however, increase in severity when blood escapes into the lung-substance, as does likewise any cough previously present. The only symptom really important is hæmoptysis, in the forms of tinged mucus, striae of blood, pure blood, rarely florid, rather darkish, of bistre tint, or even sooty-looking. The quantity of blood is habitually small; and I have never once, out of a very considerable number of cases, known anything like profuse hæmorrhage attendant on nodular pulmonary apoplexy. I should not venture yet to say that there is any special appearance in

* Foxbury, U. C. H., *Males*, vol. x., p. 133; also Whittaker, U. C. H., *Males*, vol. xviii., 1861.

the blood positively distinctive of its apoplectic origin ; still my memory does not supply me with a single instance of bistre or sooty-coloured blood coming from the lungs, except in cases of the sort. Where sanguineous expectoration of this character has ceased before death, the nodules have exhibited signs of absorption. It is to be remarked that red discs may often be found in the sputa of persons with mitral disease, where there is no blood visible to the naked eye ; and, conversely, numerous nodules may be found after death, though not the slightest hæmoptysis had existed during life.

1204. *Physical signs.*—The physical signs of nodular hæmorrhage are, also, very obscure. The effusion of blood must, to say the least, be rarely sufficiently great to act as an impediment to chest-motion ; such effect has certainly never fallen under my notice.

If the nodules be few and small, percussion and auscultation give no positive information. But under the converse circumstances, I have known the vocal vibration somewhat intensified over the nodular masses, and the percussion raised in pitch and rendered very notably dull. Over the accumulated blood the respiration is weak ; beyond it, harsh, bronchial, or diffused blowing ; the state of vocal resonance varies. If there be hæmoptysis, thin, liquid rhonchi will be present. Even within the apparent area of the apoplectic nodules, fine bubbling, almost crepitant rhonchus, may sometimes be caught on full inspiration ; but it would of course be impossible to prove that the rhonchus ever really originates within the nodules.

Instead of undergoing gradual absorption, pulmonary apoplexy may act as a source of irritation ; the signs of local pneumonia, abscess, and, in rare cases, even of gangrene, may then be successively noted.

1205. *Treatment.*—In regard of treatment, assuming that there are no signs of copious discharge of blood, I am disposed to insist most strongly on the value of extensive and repeated dry-cupping of the chest. I have repeatedly known hæmoptysis stopped almost at once by this measure, in cases of mitral disease, when the general aspect of the patient forbade the abstraction of blood. A small quantity of blood may be locally removed with propriety, where there is no prominent asthenia ; or, if the hæmoptysis and attendant dyspnoea be very urgent, venesection to the amount of some six or eight ounces, is permissible, and sometimes gives extraordinary relief.

Counter-irritation, by blistering or otherwise, and free purgation, are the next most important remedies. The treatment must always be controlled by the state of the heart and of the secondary disorders dependent on that organ. Unless the hæmoptysis be considerable, it is not advisable to employ the ordinary astringents, or other more powerful remedies to be by-and-by enumerated. Digitalis will prove useful or detrimental according to the condition of the heart's substance and orifices.

IX.—HÆMOPTYSIS.

1206. Under the title of hæmoptysis, or expectoration of blood, may be included all instances of discharge of that fluid (either in minute or in large quantity) from, or through, any part of the air-passages below the epiglottis.

1207. *Conditions of origin.*—Hæmoptysis sometimes takes place during the ascent of lofty mountains, when a certain altitude has been reached [1210]. It may follow wounds of the lung and injuries of various kinds to the chest; and it may take place *cicarily*, as a periodical discharge in females, instead of the catamenia. Hysterical women, too, occasionally expectorate blood, in whose chest no positive evidence of disease can be discovered: rather a dirty-coloured, airless, evil-smelling, bloody fluid than actual blood. Fonssagrives (op. cit. p. 498) believes this hysterical bloody sputation comes from varices of the veins of the pharynx and œsophagus.

Except under these circumstances, whatever be its immediate and direct mechanism, hæmoptysis is a sign of disease of the air-passages, lungs and appendages, or of the heart or great vessels.* It may be that in certain instances of scurvy, purpura, malignant typhus, and the hæmorrhagic exanthemata, slight escape of blood through the bronchial tubes occurs; but I know, that even in the worst cases of the kind, hæmoptysis may be totally absent.†

The conditions which are more or less frequently attended by hæmoptysis, trifling or grave, may be tabulated thus:—

- I. Hysteria.
- II. Vicious pulmonary congestion.
- III. Diminution of barometric pressure.
- IV. Violent efforts and fits of passion.
- V. Blood diseases—various hæmæmias, septicæmia, &c.
- VI. Wounds and injuries of the lungs.

* Carcinomatous disease of the œsophagus may lead to spitting of blood. I have not actually observed this, except where the air-passages were perforated, but conceivably it might occur independently of this condition.

† C. Lennell, U. C. II., Females, vol. ii. p. 217. Hæmorrhagic variola and

VII. Local Diseases.	<i>Larynx</i>	Ulceration, phthisical, cancerous, syphilitic;
	<i>Trachea</i>	Ulceration;
	<i>Bronchi</i>	Bronchitis, simple and plastic; ulceration; cancer; fragility of vessels of mucous membrane;
	<i>Bronchial glands</i>	Tubercle, cancer;
	<i>Lung</i>	Congestion, active, passive, and mechanical; pneumonia, acute and chronic, plastic and caseous; abscess, gangrene; curdiness, tubercle, cancer, hydatids,
	<i>Pulmonary arteries</i>	Atheroma of, * aneurism of minute or large branches;
	<i>Air passages generally</i>	Perforative disease from without, cancerous or other;
	<i>Mediastinum</i>	Tumor; abscess;
	<i>Heart</i>	Mitral disease; hypertrophy of the right ventricle, dilatation with feebleness of the left ventricle;
	<i>Great vessels</i>	Aneurism of aorta; aneurism of pulmonary artery; quasi-congenital; coarctation of arch of aorta.†

1208. But, although it be impossible to ignore in pathology the power of all these affections to produce hæmoptysis, in actual clinical practice the symptom is so frequently connected with tubercularisation of the lung, that it comes to be one of the most significant symptoms of phthisis. The mechanism and laws of tuberculous hæmoptysis will hereafter be considered. In the present place I shall simply place before the reader an analysis of the clinical evidence I have been able to collect, practically illustrating the closeness of connection between hæmoptysis and pulmonary tubercle in the adult.

"The quantity of blood voided, is the first point for consideration. It is commonly said that the expectoration of streaked or tinged sputa is utterly insignificant, because such are seen in *bronchitis*; but no attempt has ever been made to decide numerically to what extent this is true. I find that in twenty-five cases (observed at Brompton, and at University College Hospital) of chronic bronchitis with or without marked emphysema (*but always without serious disease of the heart*), the absence of such expectoration was noted in nineteen cases, its presence in six. Now in *all* these six cases of streaked expectoration, there was more or less ground for suspicion that tubercles were to a slight amount present,—in two of them this was proved to be the fact by *post-mortem* examination. While, then, as I have found, bloody expectoration occurs in 71·79 per cent. of tubercularised persons in the first stage, it occurred in 24 per cent. of bronchitic

scarlatina combined; hæmorrhages from various textures, sloughing of the tonsils, breaking up an lunate form of blood-discs, entire separating under pressure *before death*, &c. Here there was no particle of hæmoptysis.

* On the infrequency of this mechanism, it is unnecessary to insist; I know of but one well-defined example, that recorded by Prof. Schroeder (Med. Times, 1855). Repeated grave hæmoptysis had frequently occurred, the patient perishing from cerebral hæmorrhage.

† Case of Gunnes, Clin. Lect., "Med. Times," 1855.

people, free from serious cardiac disease; but in all of the latter there was either suspicion or certainty of the existence of tubercle to a slight amount: pathologically, these people were *latently* tuberculous persons, with superadded bronchitis; but practically, they could only be regarded as bronchitic. The mean duration of the disease in the phthisical cases was 26.55 months, in the bronchitic 49.50; hence the significance (*quoad* tubercle) of hæmoptysis is greater even than the relative per-centages above given would signify. Streaked or tinged sputa are rarely or never the 'first symptom' of phthisis; should they appear in this guise, then they would probably be dependent on some other cause. The question of hæmoptysis in plastic bronchitis has already been referred to [610].

"*Primary cancer of the lung and mediastina*, as I have elsewhere shown, from the analysis of a small number of recorded cases, is very frequently attended with sanguineous expectoration or pure hæmoptysis." In regard of this symptom, the two diseases may be thus compared:—the per-centage of hæmoptysis of all amounts in cases of cancer is 72, in phthisis 40; while hæmoptysis above one ounce occurs in cancer and phthisis in the ratio of about 70 to 40. Hence 100 cases of cancer of the lung will be attended nearly as often with hæmoptysis of all amounts, and greatly more often with hæmoptysis above an ounce in amount at a time, than 100 cases of phthisis. But, on the other hand, tuberculous is so vastly more frequent than cancerous disease of the lung, that the share of the population suffering at any time from cancerous hæmoptysis will form but an insignificant fraction of that suffering from hæmoptysis of tuberculous origin."

The relationship of *empyema* to hæmoptysis has already [722] been considered.

"*Simple chronic (true plastic) consolidation of the lung* has not, in my experience, been attended with hæmoptysis to any amount."

"*Acute pneumonia*, accompanied with decoloration of face &c., is almost positively connected with tuberculous hæmoptysis [1120]."

"*Gangrene of the lung* is rarely attended with hæmoptysis in the adult; in infancy (when tuberculous hæmoptysis is very rare) it is rather common."

"I have never known *ulceration of the larger pulmonary vessels* discharge of blood to any extent; streaks are its only indication. But ulceration of the larynx, proceeding from tuberculous disease, does not occur as a primary affection: at best I have known it

* *Nature and Treatment of hæmoptysis*, p. 112.

except in follicular sore throat, phthisis (which may be completely latent in regard of the lung), cancer, and syphilis.

"Hæmoptysis arising from *disease of the heart* can with difficulty be confounded, even in itself, with the severer forms of phthisical hæmorrhage; while the physical signs of the cardiac disease will point to its true source in such cases of the slighter form. I have never once seen cardiac disease, of such kind as to cause hæmoptysis, coexistent with *phthisis*, using the term in its practical sense; but in a fair number of instances I have seen advanced cardiac disease in persons whose lungs contained *crude tubercles and gray granulations*." *

Hence it may be, that the conditions of the system existing in heart-disease are unfavourable to the development of tubercle; but the infrequency with which the two kinds of disease are found together doubtless depends, in the main, on the difference in the periods of life at which each is especially prone to occur [1281].

"*Aortic aneurism*, opening into the trachea, may, without proving immediately fatal, give rise to hæmorrhage, indistinguishable by its own characters from profuse pulmonary hæmorrhage. The history of the case, the physical signs, the age of the individual, &c., commonly establish the diagnosis; but when the aneurism is small, and so placed as to elude percussion, and pressure-signs, both concentric and eccentric [485], are absent, the difficulty of *proving* the presence of aneurism may be insurmountable; the existence of the disease may be divined, but not demonstrated. It is to be remembered that the absence of notable signs of tuberculisation does not justify the inference that the hæmoptysis is not phthisical, seeing that a tremendous pulmonary hæmorrhage may occur when slight consolidation exists at one apex only, and that such consolidation might be supposed to depend on the pressure of an aneurism.

"It is matter of common belief that in women who menstruate imperfectly and irregularly, the expectoration of a small quantity of blood is insignificant. I think this *perhaps* true where streaks only are concerned; but in every instance I have observed, *except one*, where such succedaneous hæmoptysis reached an ounce or upwards, there has been either evidence, or ground for suspicion, of tuberculisation. Similarly I have seen two cases of individuals presumably in a state of perfect health, who, in a violent fit of

* And also, in rare instances, I would now add, the conditions of retrograde phthisis.

passion, brought up a certain quantity of blood from the lungs: *both had latent tubercles.*"* Since the above passage was written, I have, however, seen two cases of so-called *various pulmonary menstruation*, in which neither local or general symptoms, nor the course of events, pointed to the existence of lung-disease of any kind.

1209. I have met with several instances where individuals, apparently in perfect health, have, under violent effort, had more or less copious hæmoptysis. In some of these cases rapidly destructive phthisis has ensued; but close inquiry has then commonly disclosed evidences of previous failure of health. The bearings of this important matter will be further considered with the natural history of phthisis [1241].

1210. The connection of hæmoptysis with the ascent of mountains is so mixed up with the other symptoms of the so-called *soroche*, or mountain-sickness, that an enumeration of them all, on the authority of a medical observer, who has actually experienced many of the group, may here be given: † cephalalgia, vertigo, tinnitus, somnolence or insomnia; dyspnoea, quickened breathing; hæmorrhage, palpitation, syncope, capillary stasis; thirst, nausea, vomiting, anorexia; muscular fatigue and lessened contractility; dry, rugous, cyanosed state of the skin.

The effects of the lessened air-pressure, in point of fact, are congestive, and whatever organ may be predisposed will probably prove the main sufferer. A gentleman, who has made many excursions in the higher plateaux of the Andes, tells me that in his case, vertigo, cephalalgia, and nausea relieved by epistaxis, with hæmorrhoidal flux, were the results. It would appear that, as a rule, hæmorrhages of any kind do not occur with frequency, until an altitude of 17,000 to 20,000 feet has been reached. Bous-singault, d'Orbigny, and Roullin make no reference to hæmoptysis as having occurred in their visits to the Andes; and de Saussure observed nothing of the sort in his ascent of Mont Blanc. M. Rémy and Mr. Brencley, who reached the summit of Chimborazo (21,424 feet above the sea-level) in November, 1856, suffered greatly from thirst, but specially insist on their having been perfectly free from inconvenience in breathing.‡ There seems,

* Author's Report on Consumption, "Brit. and For. Med. Chirurg. Review," January, 1849.

† Guilbert, *Traitement de la Phthisie*, p. 32; also Bonelli, *Travels in Bolivia*, vol. i. p. 210; and Speer, in *Ranking's Retrospect*, vol. xvii.

‡ It may not be wise, however, to draw any general inference from the experiences of a man whose physical conformation and pulmonary development are, as in the

then, some reason to surmise, that where the ascent of mountains produces hæmoptysis, the lungs, heart, or great vessels, are already latently diseased. If otherwise, why should so very small a proportion of those, making such ascents, expectorate blood? True, explorers do not all mount to the sufficing altitude.*

A curious fact long ago recorded by Dr. A. Smith † is, that persons labouring under grave hæmoptysis, at Lima, lose it at once at an elevation of 14,000 feet—an altitude at which he admits “healthy” people would run a risk of bleeding from the lungs.

The notion, that the lessened amount of oxygen at high altitudes explains the phenomena observed, is set aside by the observation of Payerne, that divers, on remounting to the upper air, experience the same effects.‡

1211. The tendency of my experience, then, is clearly to show the vast frequency with which hæmoptysis is in some manner or other an attendant on tuberculous disease. The fact, that individuals are occasionally met with who, after having had more or less profuse hæmoptysis, live on to a good old age without exhibiting phthisical symptoms, does not invalidate this result; it simply confirms the inference, clearly attainable on other grounds also, that tubercularisation tending to hæmoptysis may, as well as that not so tending, undergo spontaneous suspension.

1212. *Characters, and mode of ejection.*—Hæmoptoic blood from the lungs is in the great majority of cases brightly florid; but it may be of mixed florid and dark tints; or it may be wholly dark, almost black. As a rule, dark tinting is only observed where the blood is small in quantity. But occasionally, where profuse, it has been quite venous in colour; this would seem to point to the pulmonary artery as its source. In discharge from large-sized aneurisms of the pulmonary artery it has sometimes been dark: § in cases of small pulmonary aneurism in the wall of a cavity, brightly florid. || The difference may depend, it is suggested by Rasmussen, on the rapidity with which the blood is brought up,

case of Mr. Brenchley, exceptionally fine. Of the powers of endurance of this traveller an idea may be gathered from his having performed the following feat without, as he has assured me, suffering the smallest eventual inconvenience. He ascended the Pichincha peak, near Quito, 16,000 feet above the sea-level, descended the crater, estimated to reach to a depth of 2,000 feet, reascended this, and, night coming on, slept in the snow at the summit, without any sort of protection.

Very elaborate observations made on himself with the anapnograph, the sphygmograph, &c., during the ascent of Mont Blanc, have been recently reported by Lartet to the Acad. des Sciences.

* Ed. Med. and Surg. Journal, vol. 54, p. 12. 1840.

† *Annuaire des Sc. Méd.*, 1853.

‡ *Forstn. Lancet*, 1840-41, vol. i. p. 679.

§ Rasmussen, *loc. cit.*

and the amount of air-admixture. Niemeyer looks to the bronchial arteries in explanation of the ordinary florid tint: he gives no proof, however. Nor can I, of the view which seems to me more likely to be the true one, that the blood, in the common form of hæmoptysis in the early conditions of tuberculous disease, comes from the pulmonary capillaries and radicles of the pulmonary veins. The blood is aerated and frothy, unless very copiously and rapidly ejected.

When in moderate quantity, the blood is voided by the act of expectoration; it escapes in gulps from the mouth, when profuse; or may be ejected with efforts resembling those of vomiting. I have observed some few cases in which hæmoptysis took place solely in decumbency.

1213. *Symptoms.*—Hæmoptysis is very commonly immediately preceded by slight dyspnoea, anomalous sensations about the chest, tightness, weight behind the sternum, or at some other spot of the thorax, to which the patient will sometimes confidently point as the seat of mischief. I have known most urgent dyspnoea attend the discharge,—quite irrespective of that produced by the patient's anxiety as to the result. The pulse may be much accelerated or remain at its previous standard. There is a calm and an excited variety *quoad* cardiac action.

1214. *Diagnosis.*—The diagnosis of hæmoptysis in general may be considered in the present place; while we reserve for future consideration any special points bearing upon its connection with particular diseases of the lungs and heart.

(a) *Hæmorrhage from the mouth and fauces* can be distinguished, by careful inspection of these parts, from hæmoptysis. The blood trickles from the mouth as the patient lies sideways, and sometimes may be seen issuing from a point or welling from an islet of surface. In case of doubt, the mucous membrane should be carefully cleansed with a sponge under a strong light.

(b) *Epistaxis*, under ordinary circumstances, cannot be confounded with hæmoptysis; but sometimes blood, instead of coming forwards from the nares, trickles backwards, and may be, from time to time, coughed up. But here, again, close examination of the nares anteriorly, and of the pharynx, will disclose the source of the hæmorrhage.

(c) Patients will often persist in assigning to the *throat*, hæmorrhage, which in reality comes from the lungs, because they first become conscious of the presence of blood, when it reaches

the former part: this is a source of fallacy against which the young practitioner must be on his guard.

(d) Hæmoptysis is distinguished from *hæmatemesis* by the following characters.

Hæmoptysis is most frequent between the ages of eighteen and twenty-five; hæmatemesis, unless vicarious from defective menstruation, rare before the thirtieth year: to both these propositions there are, however, numerous exceptions,—the most important of them furnished by the hæmorrhage of simple chronic ulcer of the stomach in the young female. Sex is valueless as a guide.

The antecedents of the patient point commonly in the one case to thoracic disease, in the other to gastric or other chylopoietic disturbance.

Hæmoptysis is immediately preceded by a class of symptoms just indicated [1213]; hæmatemesis by weight and uneasiness at the epigastrium, sometimes by nausea. A salt taste in the mouth, with tickling and gurgling sensations in the throat, often precedes actual hæmoptysis; whereas I certainly have never known this complained of in hæmatemesis.

Blood is ejected in severe hæmoptysis with efforts indistinguishable by patients from those of true vomiting; but previously to such "vomiting of blood," mouthfuls have generally been coughed up: while in some cases of hæmatemesis the blood regurgitates, rather than is vomited, and nausea even is wanting. Hæmatemesis is attended by tenderness at the epigastrium; hæmoptysis by none of this. No matter what amount of blood pour from the lungs at once, small quantities continue, as a rule, to be expectorated for a time; when the stomach is at fault, on the contrary, full discharge occurs suddenly, and there is, generally speaking, an end of the matter,—certainly no bloody or stained sputa follow. In hæmoptysis the blood is florid and frothy; in hæmatemesis dark and non-aerated: at least this is the common case. But when large masses of blood are discharged from the lungs, they may be totally frothless; and where hæmorrhage occurs rapidly from an artery into the stomach, as in cases of simple chronic ulcer, the blood is vomited at once, and of perfectly arterial hue; no time is allowed for discoloration by the gastric fluids. On the other hand, the blood of hæmoptysis may be partly, or wholly, of venous tint,—but, so far as I have seen, it never has the grumous pitch-like appearance of blood ejected from the stomach. The blood of hæmatemesis is sometimes of acid reaction; and the

blood-discs altered in outline by the action of the gastric fluids: but when these evidences exist, the case will commonly, on other grounds, be a tolerably clear one. Discharge of blood by stool is the rule in hæmatemesis; the exception in hæmoptysis: in the latter case, it comes of blood accidentally swallowed, and is never, so far as I have known, abundant.* In hæmoptysis liquid rhonchus may almost invariably be found in some part of one or both lungs; nothing of the sort exists in hæmatemesis. When the lung supplies the blood, the pulse is oftener excited, full, bounding (sometimes *bisferiens*), than when the stomach is its source: in the former case, the pulse is proportionally less quickened than the respiration; still this perversion may occur in hæmatemesis also.

The final diagnosis should never be fixed on without the aid of a careful, and thoroughly unbiased, examination of the chest, after the complete cessation of all flow of blood. Should the evidence of chronic changes at the apices exist, doubtful opinion in favour of pulmonary origin would at once be strengthened. But the absence of such changes would not exclude the possibility of hæmoptysis; for, as will hereafter fully appear, such discharge of blood may occur before any notable physical changes have occurred in the lungs; nor, on the other hand, does latent tuberculisation exclude the possibility of hæmatemesis. The state of the chylo-poietic viscera should be examined physically in aid of the diagnosis of hæmatemesis.

(e) *Aneurismal* expectoration of blood is commonly, if a chronic state, of red-currant jelly appearance. Where a sudden large discharge takes place in an individual, not previously suspected to be the subject of disease either of the lung, aorta, or pulmonary artery, the diagnosis will turn mainly, indeed solely, on the physical signs. These may be inadequate to fix opinion in either case: but such inadequacy being the more common in, is an argument in favour of, a small deep-seated aneurism. After rupture of a small sac, discharge for a day or two of bloody sputa is not commonly observed as in pulmonary hæmorrhage: but exceptions occur in both directions.

1215. *Treatment*.—The treatment of pulmonary hæmoptysis, during its actual existence, aims (a) at removing the conditions causing the flow, or (b) at stopping it, in spite of the continuance of those conditions.

* To this there is one exception. Patients, bleeding from the lungs, will sometimes continue steadily to swallow the blood, for the purpose of soothing the apprehensions of those about them; in a case of this kind I have seen really enormous quantities of blood in the alvine discharges.

(a) Now if there be evidence of congestion of the lung of an active kind, with febrile excitement and strong cardiac action, that congestion should be treated by bleeding from the arm, to an amount measured by the urgency of the symptoms, and the constitution of the individual [1070]. Slow local bleeding from the chest by leeches, I believe to be highly objectionable; the rapid abstraction of blood by cupping, however, if the patient be enfeebled by previous disease, is preferable to venesection. The head should be kept high during the bleeding; and, indeed, throughout the progress of the case: a semi-faint state tends in itself to control hæmorrhage. Leeches to the anus, or to the feet, followed by the hot pediluvium, sometimes very manifestly control hæmoptysis, where there are evidences of abdominal congestion. Nauseating doses of tartarised antimony, or of ipecacuanha, are by some had recourse to from the first; but the practice is one of which I have little experience. Tartarised antimony, it is affirmed on high clinical authority, has actually caused death under these circumstances; however, it does not necessarily increase bleeding, even though it causes vomiting,—this I have seen in the practice of others. The bowels should be freely opened with cooling saline purgatives, and watery evacuations, if possible, kept up for a day or two.

Ligature of the limbs, so as to prevent the free return of blood through the veins, has proved a timely adjuvant occasionally: Junod's exhausting apparatus will be useful on the same principle. Raising the arms over the head unquestionably stops epistaxis sometimes; I know not what effect the position may have in hæmoptysis. Free circulation of cool air, light bed-clothes, a hard bed, quietude, and silence are essential aids. Large pieces of Wenham Lake ice should be allowed to dissolve in the mouth; and the *cautious* application of ice in bags to the spine, or over the heart, I have repeatedly seen (hence I do not value the speculative objections to the practice) almost instantaneously arrest the flow of blood. Heat may at the same time be applied to the extremities. Some practitioners affirm, that the application of cold to the pudenda occasionally proves directly hæmostatic.

Among remedies controlling the action of the heart, digitalis, aconite, and prussic acid claim attention; if the heart be irritable, and the hæmoptysis moderate, the first-mentioned medicine is valuable. Refrigerants, such as nitrate of potass, sulphuric and other acids, may be employed as adjuvants.

(b) The medicines qualified to fulfil the second indication, are

the acetate of lead, given in doses of two to four grains with dilute acetic acid and laudanum, every half-hour, hour, or two hours, according to the urgency of the case; alum; ergot of rye (not so valuable, however, as in epistaxis), matico, and gallic acid. My recent experience leads me to place greater trust in gallic acid than in any other agent of the class. But if the hæmorrhage be at all severe, the doses must be large and very frequently repeated; twenty to thirty grains should be given every half-hour at first,—the dose and the frequency of repetition being gradually lessened. I have seen no ill effects from these large doses.* If there be excessive anaemia, or general feebleness, the liquor of the per-nitrate or the tincture of the perchloride of iron, or sulphate of iron with gallic acid (making a gallate of iron) may be given from the first. In various other astringents, krameria, logwood, kino, catechu, sulphates of zinc and copper, little trust is to be reposed. Nor, useful as it is in some hæmorrhages, have I often seen turpentine distinctly efficacious in hæmoptysis: still it sometimes appears decidedly beneficial. A provincial chemist told me some time since, that, on one occasion, when he had in a series of closely following attacks brought up "several pints" of blood, lead and all ordinary remedies failed, while turpentine, taken internally and rubbed into the chest and limbs, distinctly arrested the bleeding.† Drachm doses of kitchen salt, either in powder or dissolved in water, appear sometimes (I have seen the fact in three instances) to arrest hæmoptysis very rapidly,—and this, whether they produce emesis or not. Five or six drachms may be given at intervals,—and, as the agent is always at hand, it may at once be used, while other means are in preparation.

Hypodermic injection of ergotine, as suggested by G. W. Balfour,‡ seems deserving of trial.§

The general treatment of hæmorrhagic reaction and of sinking is the same in the case of hæmoptysis as of all severe hæmorrhages.

* The blood expectorated, while gallic acid is taken, often exhibits a peculiar green tint. Deep, but transparent, a very evident proof that the acid passes through the circulation. Gallic acid may also, in rare cases, produce the same tint in mucopus wholly free from blood, doubtless from unusual proportion of iron in the pus (Sharman, U. C. H., *Males*, vol. xi. p. 231). The sputa of hæmoptotic patients, taking gallic acid largely, may be free from green tint, while the urine seems to eliminate it almost wholly from the system, a soluble salt of iron giving a copious precipitate for some while, even after the gallic acid has ceased to be taken.

† But in this instance, as in some others, I have myself seen, where turpentine appeared efficacious, it was only tried after the bleeding had gone on for some time, and may possibly have worn itself out. I have never in my own practice commenced with turpentine, nor have I met any one who habitually does so.

‡ *Ed. Med. Journal*, July, 1870.

§ *Jameson, B. Med. Journal*, June, 1871.

Certain cases of tuberculous disease are marked by a tendency to frequent recurrence of hæmoptysis. Although it be demonstrable that, in the mass of cases, frequently recurring hæmoptysis does no serious evil [1303, *n*], still in any individual instance, as we know not what may be the issue of a hæmorrhage once it sets in, it seems advisable to avert its return if possible. Do we possess the means? Appropriate change of climate seems the most promising. Again, I have known an instance in which grave and frequent bleeding wholly ceased after the adoption, and apparently under the influence, of a diet entirely of fish and vegetables. The time for any faith in the prophylactic efficacy of weekly venesection (as lauded by Cheyne of Dublin, despite the unfavourable testimony of his own cases) has long passed by. I have heard (but not seen) that mercury, pushed to slight pytalism, proves a sovereign remedy in this class of cases.

IX.—DISEASES OF THE BLOOD-VESSELS OF THE LUNGS.

1216. I. *Pulmonary arteries and veins*.—The diseases of the main trunk, and first divisions of the pulmonary artery, belong rather to the subject of cardiac than of pulmonary diseases.

1217. The smaller branches of the vessel are, on the whole, but little disposed to disease, though more so than has commonly been thought.

Embolism more or less complete, and sometimes extending a good length from the capillaries, is observed in pneumonic consolidation, in pulmonary apoplexy, in gangrene, in cancerous infiltration. Diminution of calibre by pressure arises in various of the consolidating lung-diseases; contraction, to actual obliteration of the minute branches of the artery, takes place within the area of tuberculised spots—an obliteration gradually made up for by the development of a new vascular rete, which by-and-by inosculates with the bronchial arteries, and eventually, through pleural pseudo-connective tissue, with the vessels of the chest-wall.

Atrophous destruction of the capillaries forms an element of great importance in emphysema.

Thickening of the vessel-walls occurs in various forms of cirrhotic infiltration, simple and syphilitic.

Fusiform dilatation and sacculated aneurisms of very small branches of the pulmonary artery play an important part in the hæmorrhages of advanced tuberculous disease.

Impairment of nutrition, with softening and weakened resisting

power, *probably* acts as the sufficing immediate cause of such hæmorrhages in the early conditions of that disease.

Atheroma and calcification are very rare: when these changes have fallen under my notice in any well-marked degree, the patient has been non-tuberculous.

In pulmonary cancer of the infiltrated form, the smaller branches up to the larger divisions may be plugged with encephaloid masses, and the walls of the minuter branches undergo cancerous metamorphosis.

1219. II. *Bronchial arteries*.—Some of the trunks of these vessels undergo obliteration in cases of aneurism of the arch and of mediastinal tumour, when pressure chancas to act in the necessary direction [1178].

X.—ADVENTITIOUS PRODUCTS.

1219. The lungs give origin to a variety of adventitious products, which, from an anatomical point of view, may be classified as follows:—

Non-plastic products . . .	{	Saline . . .	{	Concretions.
		Animalised . . .		Fat. Sugar.
Plastic products . . .	{	Blaslemal. . .	{	Deposits . . . { Syphilitic. Typhoid. Melanic. Glandorous and farcinous. Purulent. Amyloid and lardaceous. Tuberculous. Hamatoma. Sarcoma. Cystoma. Fibroma. Osteoma. Myeloid. Carcinoma. Induration-matter. Connective tissue. Fibroid tissue. Cartilage. Blood-vessel.
				Growths . . .
				Pseudo tissues . . .
				Germinal . . . { Entozoa. Entophytes.

1220. In a practical work, however, a more useful division of these products may be made into two groups,—the one including all those entailing sooner or later destruction of lung-tissue,—the other, a number of products which exercise no destructive influence on the pulmonary substance. Two very natural groups, *clinically* considered, are thus formed. There is besides a class of products, that may be looked on as holding an intermediate place.

GROUP I. TISSUE DESTROYING ADVENTITIOUS PRODUCTS.

1221. In this group are found: Miliary tuberculation, chronic and acute; Caseous or tubercular infiltration,—“caseation,”—“pneumonic phthisis;” Typhoid deposit; Glandular and Farcinous deposit; Leucobæmic deposit; Syphilitic deposit; Cancer and Acephalocystis.

1222. The characters, common to the members of this variously constituted group, are: tendency to lung-destruction through irritative processes, in association with local symptoms and signs indicating breakage of tissue; habitual chronicity of course, and the constitutional evidences of pyrexial and colliquative waste. In other words, they possess the characters of *phthisis* in the etymological sense of the term. Are we, then, like Bayle, to make phthisis a genus, with its various species; or, in imitation of Lacunne and Louis, to limit that title to the disease anatomically characterised by the presence of true tubercle? It cannot, I presume, be contested, that, although the difficulty of distinguishing some of these disintegrating diseases during life is extreme, yet, as matter of fact, they are different. And as it seems unwise to adopt a *nominal identity* where *real diversity* exists, and so damp the efforts of those who might eventually show that pneumonic and tuberculous destruction, for example, are as readily distinguishable as they are really different, I shall continue to limit the application of the phrase pulmonary phthisis, or consumption, to tuberculous disease.

SPECIES I. MILIARY TUBERCULISATION, OR PULMONARY PHTHISIS.

1223. Tuberculation of the lung occurs clinically as a chronic and an acute disease. The chronic affection, as vastly the most common and the most important, will be first considered.

SECTION I.—CHRONIC TUBERCULISATION OF THE LUNG.

1224. Clinical, as well as anatomical, observation shows the necessity of dividing cases of the chronic class into the *progressive* and the *retrogressive*,—those in which the abnormal actions in the lung tend to destruction, and those in which they incline towards repair.

I.—PROGRESSIVE CHRONIC TUBERCULISATION. -ANATOMICAL CHARACTERS.

1225. The anatomical changes occurring in the lung in progressive chronic phthisis are referable to three main stages; and these stages sometimes correspond to certain varieties in the symptoms,

and always to modifications in the physical signs. There are, then, clinical as well as anatomical reasons for recognising three stages in the advancing disease,—those, first, of deposition with induration, secondly, of softening, and, thirdly, of excavation,—stages which present the following physical characters of clinical significance.

1226. (a) *First stage*.—The earliest-known form of this stage is the so-called semi-transparent grey granulation.

The grey granulation, about equalling a millet-seed in size, though in its own substance of greyish colour, assumes from its translucency something of the tint of the circumjacent texture: smooth and close on section, very firm, elastic, standing prominent on a cut surface, roundish or angular in outline, closely adherent, especially when first developed, to the surrounding tissue, and displaying a striking tendency to form in groups.

The grey granulation is developed in the connective tissue between the capillaries, in that surrounding the ultimate tubes, in that of the inter-cell spaces, and in the interior of the cells.

Microscopically, it consists of a non-stromal hyaline material, containing cells, some non-nuclear, others containing closely packed nuclei. It was long matter of accepted doctrine that these cells germinated in new blastema: of late, the notion has been put forward that vegetation of nuclei takes place within natural epithelial cells.

Dr. Burdon Sanderson, again, finds in animals artificially tuberculized, that the minute translucent nodules, produced in the lung by the process, consist of "two materials entirely different from each other anatomically: on the one hand, the alveoli are choked with the roundish cells always found there; while on the other, the alveolar walls are thickened by the growth in them of adenoid tissue." *

It will probably be conceded by impartial lookers-on, that the attempt to fix the microscopical nature of tubercle has reached but an early stage of advancement. How short a time has passed since the *specific tubercle-cell* figured as the cherished cardinal fact in the micrology of the disease! While, now, the doctrine of the hour not only stigmatises the distinctive cell as a pure myth, but invites us to accept articles of faith utterly antagonistic to all specificness. Thus, according to Virchow, "the cells present in tubercle may be relics of epithelial cells, or of some other natural product; or they may be related to or identical with exudation-

* *Et. Med. Surg. Journ.*, Nov. 1869.

cells, or pus-globules, or to and with the cells occurring in cancerous growths, or in typhoid infiltrations." (Ranking's Retrospect, vol. xviii.) And from the observations of Dr. Burdon Sanderson (*loc. cit.*) it would follow: "there are no elements in the induration of phthisis, which are not to be found in chronic bronchitis;"—nay, more, "it is even possible there are no anatomical elements in the induration of phthisis, which are not to be found in the healthy lung."

Now, practically, to what issue do the latter propositions point? Presumably, not to the equations "tubercle=lung-substance," and "bronchitis=phthisis;" not a whit more to the paradox, "hypertrophy of the lung and tubercle mean one and the same thing." But, inasmuch as they teach microscopical identity, "actual" or "possible," between objects so utterly dissimilar to unaided sense, there seems to be no escape from one or other term of the following dilemma: either this corpuscular identity is the dominant and essential pathological fact, and men must be wrong in considering phthisis and bronchitis different diseases; or the seeming identity that captivates the micrologist of to-day, is a quality of mere secondary and quasi-accidental importance, and the arrangements, the site and mode of accumulation, the chemical conditions, vital tendencies, &c., of these elements really give them their specific characters and their distinctive potentiality. Their dynamism, more than their statics, would hold the place of real significance. This, too, be it remembered, is an explanation adapted to the case on the assumption that the alleged identity is real. But what surety is there of this? Who can deny the probability that improved methods may not reveal, in the future, diversity undreamed of at the present day?

To return to the naked-eye characters of the granulation: having maintained the appearances described for a variable period, it loses its transparency, becomes yellowish, eventually thoroughly opaque and friable,—these changes commonly proceed from the centre to the circumference. The yellowish caseiform or tuberculous material thus formed may form considerable masses from agglomeration of original granulations.

1227. But cheesy infiltration of a portion of lung may occur without the previous intervention of the grey granulation, and seems then a fatty transformation of catarrhal and pneumonic inflammation-products, as originally taught by Addison.*

* Guy's Hospital Reports, vol. iii. p. 1, 1845. So long ago as 1848, I expressed a very similar opinion. Art. "Products, Adventitious," p. 105. 1849.

1228. Yellow tubercle, whether preceded or not by the semi-transparent grey granulation, and whether accumulated in isolated or grouped masses, or infiltrating the pulmonary stroma, affects a special preference for the apex and upper lobe,—either spreading thence downwards uniformly, or leaving islets of parenchyma of various sizes unoccupied in its transit towards the base. Exceptions to this topographical mode of progress (on which the diagnosis of the disease so often turns) are infinitely rare in chronic tuberculation,—the base of the lung proving the primary seat of the process, not oftener, it has been calculated, than once in sixty or eighty instances.

Tubercle, as a rule, exhibits little tendency to form immediately beneath the pleura, unless the deeper parts of the organ have already been involved. Rare instances, one of them recorded in the classical volume of Louis, nevertheless occur, in which the earliest traces are discovered directly under the serous membrane.

1229. The tissue, lying amid the tuberculous deposit, undergoes various changes. Exudation-matter, either thoroughly fibrinous, or of low plastic force, or readily undergoing tuberculous degradation, may infiltrate and harden the parenchyma,—a condition to which many of the physical signs are more directly traceable than to the tuberculous deposit itself. Some air-cells undergo occlusion, it may be from actual production of tuberculous material within them, but mainly from the pressure of that deposited on their confines; while, as originally shown by Carswell, adjacent air-cells undergo succedaneous distension. Obliteration of the minute branches of the pulmonary artery takes place,—a vascular loss eventually supplied, according to the investigations of Van der Kolk and Guillot, by an adventitious rete of vessels, which, at first independent, by-and-by inosculates with the bronchial arteries, and, eventually, by the channel of pseudo-membrane in the pleura, with the vessels of the chest-wall. In one aspect a tuberculous lung is less, in another more, vascularized than a healthy one.

1230. (*b*) *Second stage*.—The second stage is signified by softening and disintegration of tuberculous deposit,—and by breaking up of pulmonary tissue, impaired in its nutrition, imprisoned amid that softening material. In this process of destruction, the deposit and the tissue habitually act and react on each other; but that tubercle, like clotted fibrin, may *ab origine* soften intrinsically, no reasonable doubt can be entertained.

The length of time, tubercle may remain without losing its con-

sistence, varies so widely, that no rule of clinical utility can be established on the question.

The softening process, like that of original deposition, commences at the apex of the lung and spreads downwards.

1231. (*c*) *Third stage*.—Elimination is the essential feature of the third stage. The softened tubercle, along with various products of inflammation, and the macerated and separated parenchyma embraced thereby, are thrown off through the bronchial tubes. The resulting cavities, originally small, increase in dimensions by mutual coalescence, and by advancing destruction on their periphery: so that, eventually, almost the entire area of a lung may be represented by a single huge excavation.

1232. Although chronic tuberculation involves both lungs, as a rule, to which I have never encountered an exception, the progress of deposition and destruction is invariably asymmetrical in the pair. So true is this, that in a case of pulmonary disease of doubtful nature, the fact of uniform distribution of the physical signs (were this positively demonstrable) would be well-nigh fatal to the diagnosis of chronic phthisis.

1233. But can the relative progress of tuberculation in the two lungs be employed as an element of diagnosis? The following results of the analysis of 143 cases of phthisis throw some light on this question:

"From these propositions it follows that the disease attains the softening point with not very unequal rapidity in the two lungs. Such difference as exists signifies that the point is more quickly attained in the left than in the right organ; for it appears that softening of the left lung, the right being still firm, was more common, under two distinct points of view, in the ratios of 29.51 to 27.12, and 24.13 to 12.51. I have, however, no means of ascertaining satisfactorily whether this depends on deposition being on an average earlier in the left lung than in the right, while the actual rapidity of subsequent destruction is equal in both, or from the destructive process being more rapidly effected on the left side, original deposition being coeval on both sides.

"But, as will appear from the subjoined comparison, the laws regulating the disease in males and females probably differ in this respect, they certainly did in these 143 cases.

Tabular comparison of the condition of the two lungs in both sexes.

(143 cases)

MALES

(a) *Right lung*. 24 in first stage, 4 in which the *left* had reached the second or third stage,—that is, in 16.67 per cent. of the number.

(b) *Right lung*. 56 in second or third stage, 11 in which the *left* still remained in first stage,—that is, in 19.64 per cent. of the number.

(c) *Left lung*. 31 in first stage, 11 in which the *right* had reached the second or third,—that is, in 35.49 per cent. of the number.

FEMALES.

(a) *Right lung*. 37 in first stage, 14 in which the *left* had reached the second or third stage,—that is, in 37.83 per cent. of the number.

(b) *Right lung*. 26 in second or third stage, 5 in which the *left* still remained in first stage,—that is, in 19.27 per cent. of the number.

(c) *Left lung*. 28 in first stage, 5 in which the *right* had reached the second or third, that is, in 17.86 per cent. of the number.

(c) *Left lung* 40 in second or third stage, 4 in which the *right* still remained in the first,—that is, in 8.16 per cent. of the number.

(d) *Left lung* 35 in second or third stage, 14 in which the *right* still remained in the first,—that is, in 40 per cent. of the number.

The proportions marked (b) do not tell in one direction or the other, those marked (a, c, d) dispose strongly to the greater rapidity of evolution of the disease in the right lung of males, and in the left of females. Let it be remembered, too, that in the only two instances in which either lung was practically unaffected, it was the *left* lung of *males* that had escaped. Why the disease should advance more quickly on the right side in men, and on the left in women, does not clearly appear: if it be suggested that the greater frequency of pneumonia of the right lung in the male will explain the fact of its becoming a more rapid prey to tuberculation, the difficulty is to explain why the left should be the earlier victim in females.*

A further fact of deep clinical importance is, that the progress of the disease is not, or may not be, steadily uniform in the two lungs. The various stages may proceed rapidly on one side, slowly on the other; by-and-by all the activity may pass to the hitherto relatively quiescent side. This transference of activity may occur in any stage of the disease.

1234. Excavations, having formed, may either remain in *statu quo*, secreting purulent matter,—or they may undergo certain reparative changes. In the former case, the process of destruction may have laid bare branches of the pulmonary artery which, if lying on the confines of the cavity without lateral support, tend to become aneurismal. The latter class of changes will be described in the account of the retrogressive chronic disease.

1235. The law of the tuberculising process in the adult, many years since brought to light by the labours of Louis,—that the presence of tubercle in any organ after the age of fifteen, involves as a necessity its existence in the lung,—frequently proves of inestimable clinical value. We must not forget, however, as admitted by its discoverer, an exception to the rule does every now and then occur.†

PHYSICAL SIGNS.

1236. *First stage: Accumulation of groups of gray granulations or yellow unsoftened tubercles in variable quantity, and with or without intervening simple induration of tissue.* The extent of area occupied by each morbid condition, the tuberculous and exudative, seriously affects the results,—and, as a general truth, the induration, rather than the tubercle itself, is the cause of the physical signs during this stage.

* Author's Report on Phthisis, Br. and For. Med. Chir. Review, Jan. 1849.

† It would perhaps be better to say "about or after" the age of fifteen. Louis fixed the age of fifteen simply because he observed in hospitals, where patients were not admitted until they had attained their sixteenth year.

(a) The infra and supra-clavicular regions are either unaltered in form, or they are slightly flattened. The former is the more common of the two cases: probably, the diminished bulk of the apex, produced by deposition of tubercle and closure of *some* air-cells, is at first counterbalanced by the distension of *others*. It falls within the limits of the probable, indeed, that cases may now and then be met with, in which such emphysematous distension shall so predominate as to produce slight bulging over tuberculised lung. Many years ago, Dr. Chambers, without offering any explanation of the circumstance, mentioned to me that he had observed an increase in the antero-posterior diameter of the apex at the very outset of the disease. I have carefully watched for examples of the fact, but have never met with one, unless where percussion gave a more or less deep-toned resonance [Type II.], and where the existence of local emphysema, consequently, became strongly probable. It would appear, as matter of experience, to be impossible that tubercle alone, accumulated to such an amount as to impair in the least degree the pulmonary tone of percussion-sound, shall be the cause of bulging. The precise degree of tuberculisation, which will produce flattening, varies with many accidental circumstances, such as the relationship of the tubercles to the minuter bronchial tubes (if many of these be obstructed, local collapse of lung-substance will ensue), and the presence or absence of plastic contractile exudation within the parenchyma or on the pleural surface. Atrophy of the tissue of the lung can scarcely occur at the very earliest stage of bronchial obstruction. Flattening may sometimes very positively exist, but, from being equally shared by both sides, escape detection: when present to any extent, the clavicle is thrown into unnatural relief.

(b) Vocal vibration may very certainly be increased in intensity under the clavicle; but the amount of increase is trifling. Its existence is, therefore, with difficulty established under the right clavicle, where there is a natural excess of fremitus; and on the left side, as a sign of incipient tuberculisation, increased fremitus commonly fails us, because priority of disease on that side is most common in females, who, unfortunately, from the peculiarities of their voices, have little or no vocal vibration.

(c) Careful admeasurement with the callipers will sometimes detect very slight reduction in antero-posterior diameter at this period. If the deficiency be marked, pleural false membrane is probably present to some amount.

(d) The motions of the infra-clavicular region are perverted, to

the eye, to the hand, and to the measure. The hand laid flat on the surface, instead of being arched outwards during inspiration, is simply raised upwards; elevation-movement exists, expansion-movement is wanting; nay, more, the infra-clavicular region may actually sink in with inspiration. The first, second, and third ribs, if the costal and pulmonary pleuræ are agglutinated at the spot, may be felt to converge at the same time.* The deficiency of expansion-movement under the clavicle is a more valuable sign in the female than in the male, for the obvious reason that it is naturally much more limited in the latter than in the former [49].

(c) The results of percussion may or may not be significant. Slight decrease of pulmonary tone, and slightly increased parietal resistance, may be produced by a very few scattered tubercles at the apex,—local collapses of the lung doubtless contributing to impair the resonance. The deficiency will be earliest caught at the inner aspect of the supra-clavicular and clavicular regions (see Diagram, page 4), where the apex of the lung lies. To detect it, percussion must be very lightly made, and, for purposes of certainty, repeated in various postures both of the patient and of the percussor. Care must be taken to direct the percussion from, and not towards, the trachea: with this caution, percussion is much more conclusive at the inner than the outer part of the supra-clavicular region. Slight want of pulmonary tone is a more valuable sign in the female than in the male, and more valuable in both sexes at the right than the left side [189, 192].

Habitually a smaller superficial area of disease is required to affect the percussion-sound in the infra-clavicular than the supra-scapular regions; but occasionally the latter suffer even before the former. Sometimes, when tubercles are sparingly scattered through an entire apex, percussion on a broad surface will disclose a difference in resonance, imperceptible when a single finger is used as a pleximeter. Or recourse may be had to the dynamic tests: the increase of pulmonary tone produced by a full inspiration will prove, in comparison with that on the healthy side, very trifling; and, on the other hand, there will be comparatively a great decrease of that tone at the close of a complete expiration. As deposition, collapse, and consolidation advance, the sound acquires more and more the characters of Type I. [195], but never becomes totally toneless, or of putty-like flatness.

But instead of the attributes of Type I., the percussion-sound

* It is natural these ribs should converge in inspiration [71]. it is unnatural they should converge to an amount capable of being felt with the fingers.

may possess those of Type III. [199]. The volume of sound may be thus actually greater over a tuberculised than a healthy apex, *the rise in pitch being the real test of its morbidness*. The resonance may be wooden, or even tubular, —especially if consolidated tissue reach directly across from the costal surface to the trachea, or large bronchi, and the pleural laminae be agglutinated at the spot.

Inasmuch as tuberculisation exercises a contracting influence on the lung-substance, the morbid resonance at the apex, of whatever type it be, ought not to extend beyond the normal pulmonary outline across the sternum. And in point of fact it never does so but to a very slight degree: the conveyance of the sound beyond the limits of the lung, is then to be explained by “horizontal conduction” [221].

The fallacy of co-existent emphysema is always more or less to be apprehended during this stage.

(f) The results of auscultation vary widely, — so conflicting are the physical conditions, rarefying and condensing, implicating the tuberculised tissue.

The respiration in the infra-clavicular region, and also usually in the upper scapular, is affected in *intensity*, being weak and almost suppressed in some points, exaggerated in others; perverted in *rhythm*, being frequently jerking; impaired in *quality*, being harsh, bronchial, or even slightly blowing. The value of these states of respiration is directly as the limitation of the area within which they are discernible; if they exist above, and are imperceptible below, the second interspace, they are very seriously significant. Slight harshness of respiration is more valuable, as a sign, in the male than in the female, and notably so on the left than on the right side. If the other causes of jerking rhythm [277] can be excluded, which may or may not be difficult, this condition of rhythm, when limited to one apex (it is rarer posteriorly than anteriorly) becomes a really important sign of tuberculisation. My opinion on this point has yearly grown more positive. It is to be remembered that it occurs at a period of the disease when the physical signs generally are few in number, not so decisive as might be wished, and when, of course, every addition to their number is really important. According to my experience, jerking respiration is not a removeable phenomenon. I have not, as Dr. Stokes appears to have done, succeeded in causing its cessation by local treatment, even in cases where other signs, for instance, harshness of respiration, were favourably modified by that treatment. On the other hand, it often wholly

disappears spontaneously with the advance of the disease,—so that its cessation becomes an evil sign. It may exist in the highest degree without any co-existent affection of the pleura; and must not be confounded with grazing friction-sound.

Prolonged expiration, if unattended with alteration of quality, is insignificant: under such conditions, it is in all probability a normal state; and even coupled with slight harshness and coarseness of quality, it must be cautiously received as evidence in females, and at the right side.

The only rhonchal sound specially belonging to this stage of phthisis is the dry crackling; occurring towards the close, it gradually passes, with the exceptions already referred to [327], into the humid crackling variety.

Occasionally at the close of this stage the peculiar condition I have designated as *cogged-wheel rhythm* of respiration, exists,— oftener in the supra-spinata fossa, than below the clavicle [278].

The vocal resonance varies to such an extent in amount and quality, as to make it totally unworthy of clinical confidence: I have known it (where the existence of consolidation was positive, either from other signs, or, in addition, from *post-mortem* examination) of the average characters of health; weak; null; exaggerated; intensely bronchophonic, or pectoriloquous. The state of vocal fremitus, curiously enough, does not vary thus, and is hence, comparatively, a more trustworthy guide: but its positive value, we have seen, is next to nothing.

In a doubtful case of tuberculisation of the right apex, if the heart's sounds, but especially the first, be more clearly audible near the clavicle on that side than the left, we have herein presumptive proof of consolidation; but the absence of this sign will not disprove the existence of solidity, of which strong evidence appears on other grounds. Subclavian murmur may be present; and also systolic murmur at the second left, or pulmonary, cartilage, associated or not with basic systolic, or with subclavian, murmur. Of the mechanism and feeble diagnostic significance of both these murmurs enough has already been said [464-5]. Subclavian murmur certainly may occur in the male in the female it is infinitely rare) at an early period of consolidation,—but to assume its morbid mechanism would be rash in the extreme.

(g) *Accidental signs*.—The signs of dry or plastic pleurisy, and of bronchitis and of pneumonia, may occur in connection with tuberculous deposition; they have indirect value, if limited to one or both apices. Tuberculous patients, the apex of whose lung is

the seat of capillary bronchitis, are of course liable to be seized with idiopathic bronchial inflammation of both *bræe* from accidental causes. Under such circumstances, it is curious and interesting to observe the manner in which the upper and lower rhonchi travel towards each other, so as eventually, in some rare instances, actually to meet towards the middle height of the lung. Such union of these rhonchi is commonly of serious import. I may further observe, with respect to the symptomatic rhonchi occurring in connection with tubercle at the apices of the lungs, that I have found true pneumonic crepitation, to say the least, singularly rare: that is, unless in cases where the cause of the rhonchus is really extensive pneumonia,—such pneumonia as shall during its existence assume, in point of clinical importance, all the characters of the idiopathic inflammation. Under the ordinary circumstances of acute irritation setting up in the neighbourhood of the new matter, fine bubbling is the rhonchus audible, and and capillary bronchitis the anatomical state present.

1237. *Second stage.*—The signs of the second stage, that of *softening*, are in part new, in part those of the first stage, either stationary or carried to a higher point.

(a) *Precious signs modified.*—Depression both above and below the clavicle, is now greatly more marked, and may sometimes be really present to a notable amount, but be masked by twisting of the clavicle downwards and inwards on its long axis. When the clavicle thus, as it were, follows the retreating ribs, the callipers, or chest-measurer, supply the only trustworthy evidence as to the amount of depression. The corresponding supra-scapular region, if one apex be more affected than the other, is distinctly hollower than its fellow,—a fact apparently so strange, that nothing but repeated observation would justify its statement.—The vocal vibration does not increase as a consequence of the softening process: but as this process is, generally speaking, accompanied with extension of induration also, such increase *may* occur.—The semi-circular measurement of the side, and the transverse diameter of the chest in the axilla, are lessened in consequence of the general deposition of tuberculous matter, atrophy, and interstitial contraction of the lung, together with, in some cases, contraction of pleural false membrane.—Morbid resonance under percussion gains in area and in intensity, and is, oftener than in the first stage, wooden or tubular.—The respiration grows more extensively and markedly blowing, or remains merely bronchial. Vocal resonance varies as before.

(b) *New signs.*—The new phenomena in this stage are humid crackling, and thin metallic bubbling rhonchus. When elimination of the softened material commences, the rhonchus may become cavernous on a small scale.

In consequence of the diminution of the mass of the lung, the heart may be elevated above its natural position, the diaphragm raised, and the mediastinum drawn towards the mainly affected side. Although the heart's bulk, as a law of the disease, gradually diminishes, its area of superficial dullness may be apparently increased, in consequence of contraction of either, but especially of the left, lung.

1238. *Third stage.*—(a) The signs derived from inspection in the third, or excavation, stage remain as previously. I have, however, in some rare instances, known extreme infra-clavicular depression, produced in the second stage, diminish somewhat, nay, *even give place to slight bulging*, where a *capacious* excavation had formed. This will probably occur where the anterior wall of the excavation is excessively thin, indeed merely membranous; the condition becomes one, physically speaking, closely assimilable to local pneumothorax: at all events, of the clinical fact I am positive. Again, in such cases, inspiratory expansion may improve to a certain extent. I have observed this in a case where amphoric respiration gave evidence of the size of the excavation; and the more solidified the rest of the lung, the greater will be the expansion over the cavity.*

(b) Rhonchal fluctuation may sometimes be detected; and if the cavity be of large dimensions, fluctuation, producible by succussion of the trunk, may be felt.

(c) The percussion-results depend less on the fact of cavity existing, than on the conditions of the cavity. If it be small, and surrounded with much indurated lung, the sound will habitually be either high-pitched and hard, or wooden, or tubular. If there chance to be a thick stratum of normal tissue between the excavation and the ribs, gentle percussion may be of almost healthy quality,—moderate dullness, slightly tubular, too, is on the other hand detected by strong percussion. If there be several small excavations, with indurated substance between them, the sound is markedly dull, and somewhat tubular; if one or two large excavations, amphoric or of cracked-metal quality.†

* Green, U. C. H., *Females*, vol. v. p. 148; July, 1850. Expansion is very rarely totally deficient over a large-sized cavity; greatly more rarely than over highly consolidated texture.

† Cracked-metal quality may be found directly over a spot in a state of induration

(d) The respiration, provided the cavity be neither distant from the surface, nor separated from it by a stratum of healthy tissue, is usually divided, hollow, hoarse, blowing, and cavernous, or actually amphoric; and this state alternates or co-exists, in the manner already described [303], with gurgling rhonchus. The cough is cavernous or amphoric; and metallic echo, or metallic tinkling in some rare cases, accompanies the voice, cough, and respiration.

The following *exceptional conditions* are particularly worthy of a zealous student's attention. First, the respiration may be null over a large cavity, at least at its upper part,—cavernous rhonchus existing below. Secondly, over the entire area of a large cavity there may be *dead silence*,—respiratory, vocal, and rhonchal. Thirdly, there may be a sort of confused *shadow of a sound*, if I may use the expression, which reminds one strongly of Shelley's oft-quoted phrase—

“When night makes a weird sound of its own stillness.”

(e) The vocal resonance hopelessly varies: it may be pectoriloquous, amphoric, bronchophonic, natural, weak, or null: hence vocal resonance should never be seriously appealed to in the diagnosis of a cavity. The form of resonance most nearly distinctive of an excavation, is *whispering* pectoriloquy: but cavities may exist without this; while resonance of the sort may exist under physical conditions directly the reverse of excavation [411].

(f) A cavity of large size, with hard and smoothish walls, and containing thin fluid in moderate quantity, may not only emit a gurgling sound when the trunk is abruptly shaken, but the heart's action, too, if the cavity be near, may produce a similar sound of cardiac rhythm.

(g) Where great loss of substance is effected in the right lung by excavation, and its remaining tissue is much reduced in bulk, the heart may be drawn greatly out of its place, and beat to the right of the sternum,—this form of sign is most distinctly marked, however, where, in addition, contraction of a large cavity has set in.

SYMPTOMATOLOGY.

1239. The symptoms of progressive phthisis do not admit of such systematic division into stages as its physical signs: there is

only,—a small cavity, not larger than a walnut, existing at an inch or two distant (Bowen, P. C. H. *Fundamentals*, v. 1, xv. p. 390). This may be another example of *horizontal contact* in [221], or of the cracked metal note of mere consolidation (210).

a symptom absolutely peculiar to any one of the three anatomical stages. It will be better, therefore, to consider them *seriatim*, under the heads of *local*, *general*, and *incidental*.

1240. (1.) *Local Symptoms*.—*Cough*, unless in latent cases, is an essential symptom; habitually unpreceded by coryza, rarely paroxysmal, it is at first either dry (but this, very probably, in not more than about one-tenth of cases) or attended with expectoration. Slight at first, merely a clearing of the throat, the cough gradually grows more forcible, though, as a general rule, the effort to remove the sputa is not seriously strained. In certain rare instances, the cough, paroxysmal and excessively violent, is evidently sustained by some exceptional form of irritation,—probably, a neurosis of the vagus [936]. The cough more frequently brings on vomiting or nausea in phthisis, than in any other pulmonary affection: if a fit of coughing occur shortly after a meal, more or less of this is habitually vomited in the majority of cases that have reached the second stage.

The *expectoration* at the outset is colourless, frothy, watery or mucilaginous-looking. When of the latter appearance, a deposit in small quantity takes place of a thickish, grumous substance of pale greyish tint, and not unlike the sort of curd that is often seen in barley-water. It has not occurred to me to observe this peculiar appearance except in phthisis.

Gradually, sometimes abruptly, the sputa grow distinctly glairy and muco-epithelial; presently purulent striae appear amid these, contrasting by their opaque, pale buff or yellow tint, with the lighter coloured and more transparent mucous body of the sputum, which grows less and less aerated. Suddenly a total change may occur: the sputum becomes essentially purulent, consisting either of small pellets with jagged, sharply cut outlines, opaque, semi-floating, non-aerated, and of dirty yellowish colour (so-called boiled-rice sputum),—or of larger masses with ragged edges,—or of broad, flat, discoid lumps, darkish green in tint, smooth in outline, and remaining apart if expectorated into water. These different forms of purulent excretion may be variously associated; and, if fresh simple bronchitic irritation supervene, may be mixed with frothy fluid again.

Eventually the sputa acquire an ash colour, run together in one mass, totally free from air, and are constituted essentially of pure pus. Occasionally sudden profuse expectoration of purulent fluid occurs, in some cases traceable to abrupt evacuation of a cavity, in others to abundant secretion from the walls of old cavities and

neighbouring bronchi; both occurrences are to be distinguished from discharge of empyema through a perforation [767].

The odour of phthisical expectoration is nauseous, *sui generis*, not actually foetid. It may accidentally acquire the wet-mortar like, or putrid smell of gangrene, under circumstances already described [592].

The quantity of expectoration varies greatly in a mass of cases: sometimes profuse, especially in the earlier and closing periods, it may be very slight throughout; and I have known cases run their course without any expectoration at all. I once saw a lad, aged fifteen, admitted into hospital with typhoid (Peyerian) fever, become phthisical during convalescence, and, dying within a short period, present large cavities in his lungs, though he had never, as far as could be learned by constant questioning, expectorated a single sputum: he must, of course, have swallowed them all, as *children* almost invariably do.

The microscopical elements of phthisical sputa are very numerous. First, epithelium tessellated, cylindrical and ciliated, from the bronchial tubes; salivary fluid, and epithelium from the mouth. Secondly, blood-disks (even when no reddish tint exists to the naked eye), melanic cells and molecules, molecular fat, oil globules, and saline matter, crystalline and amorphous. Thirdly, exudation-matter in patches, exudation-cells, and pus-cells. Fourthly, fragments of pulmonary fibre, capillary vessel and nerve. Fifthly, dark molecular matter, soluble neither in ether nor in hydrochloric acid, and probably tuberculous,—and, occasionally, cells possessing characters identical with those found within the alveoli. Sixthly, the vibrio lineola and mycodermatous entophytes.

Now the presence of fragments of tissue indicates breakage of the lung-substance, and may furnish, not only the earliest, but for some time the sole, positive evidence of tuberculisation. I have seen this in a few instances (always young females), in whom the general condition, as well as the local symptoms pointed to phthisis, while satisfactory physical signs were wanting. Besides, the existence of alveolar cells, if certain, is, probably, distinctive of phthisical disease. Otherwise the characters enumerated have no precise diagnostic signification.

Of the chemical characters of the sputa I know little. Popular opinion, looking upon the change from saline to sweet taste as of evil import, is probably well founded: for in the outset the sputa, essentially those of catarrhal flux, are markedly saline;

with the advance of the disease and obstruction of lung they may become saccharine. Sugar, however, is by no means always to be found.*

In the course of phthisis calcareous particles and masses, merely gritty or of petrous hardness, and in size from a pin's point to a pea, may be expectorated. I have known this continue for years steadily or interruptedly. But while such expectoration is a clear proof of local retrogression, the tuberculising and softening processes may in other parts of the lung be actively advancing.

1241. *Hæmoptysis*, including under this term even expectoration simply streaked with blood, is a symptom of extreme frequency, occurring, as I formerly found (Brit. and For. Med. Chir. Rev., January, 1849), in about 81 per 100 of cases. The following general inferences are derived from the examination of 106 hospital patients:—

* *Hæmoptysis* was of very slightly (4 per 100) more frequent occurrence in males than females. *Hæmoptysis* to a medium amount is about four times less common than to very slight or to profuse amounts,—both taken together. Very profuse hæmorrhage from the lungs is more common in males than females.—Medium frequency of recurrence of hæmoptysis is materially less common, and this in both sexes, than a single or than repeated attacks. Further, repetition of hæmoptysis is more common in males than in females.—It is materially more common for a first hæmorrhage to be more profuse than subsequent ones, than for subsequent ones to be more profuse than the first.—*Hæmoptysis* is more frequently met with, and this independently of any influence of duration of the disease, in persons who have reached the second and third stages, than in those whose lungs have not yet softened. This proposition is more markedly true of males than of females.—There does not appear to be any notably greater tendency to hæmoptysis, where the right lung has reached a more advanced stage than the left, than, *vice versa*, where the left has taken the lead. It seems improbable that either lung is more effective in causing hæmoptysis than its fellow.—The frequency of hæmoptysis increases with advancing years in both sexes. The increase is more abrupt in females than in males, and in the former appears connected with the catamenial function.—This greater frequency of hæmoptysis in persons of more advanced years, does not depend altogether on greater duration of the disease; for those, who had had hæmoptysis, had been phthisical for only a mean period of eight months longer than those who had not spit blood.—The most common periods for the occurrence of hæmoptysis, were, at the very outset, or after the expectoration of the first month; it is very rare for hæmoptysis to occur within the first month, unless it has actually appeared as the first, or among the first symptoms. The phrase 'first symptom' here is to be understood with a qualification to be by-and-by explained.—In upwards of half the cases of notable hæmorrhage (beyond 4 oz.) this occurs, or has occurred, as the 'first symptom,' corroborating the inference as to the excess of amount of first over subsequent hæmorrhages.—Hæmorrhage of this amount is rare as a coexistence with other first symptoms (in 1/8 of these cases) appreciable by the patient.—Streaked or tinged sputa are, on the contrary, of very common appearance amongst the earliest symptoms.—But streaked or tinged sputa are rarely, or never, the 'first symptom' singly and alone.—Season does not appear to exercise any marked influence on the occurrence of a first hæmorrhagic attack.—*Hæmoptysis*

* Thus the sputa of Nettle ships, U. C. H., Males, vol. x. p. 146; and of M. Harris, U. C. H., Females, vol. ix. p. 326, both in the third stage, were boiled for twenty minutes with two parts of distilled water, then treated with acetate of lead and soda; the filtered fluid gave no evidence of sugar with Trommer's, Foggiale's, or the bichloride of tin tests. These results, carefully obtained by my clinical clerk, Mr. W. T. Foster, were confirmed by actual analysis in the Birkbeck Laboratory of University College.

never appeared as the *bona fide* first symptom in these cases, the phrase being understood in its absolute sense without qual hesitation, it is so only in the sense that it is the first symptom particularly noticed by patients—the first occurrence that leads them to watch their health.”

All my later experience supports, in the main, the teaching of the last proposition, which leads us to reject, as habitually untenable, the old notion that phthisis is really caused by hæmoptysis in instances, where it *appears* to lead the way in the train of morbid events,—in other words, to question the soundness of the ancient formula “*phthisis ab hæmoptoe*.”

But, on the other hand, in those remarkable cases where a sudden outburst of blood from the lungs is then and there followed by phthisis, are we to assume the hæmorrhage is always the exponent of a present, and hitherto wholly latent, tuberculisation? The evidence before us scarcely justifies such a conclusion. Take the case of a young adult, powerfully built, of untainted stock, who, “never having known a day’s illness,” and indulging habitually, with perfect impunity, in athletic sports, strains himself in an awkward posture in lifting down a heavy body from a high shelf, instantly finds his mouth full of blood, rapidly coughs up a quart of the fluid, in a week is obliged to take his bed with active chest-symptoms, and perishes in the course of three months and a half with all the local and systemic evils of ordinary phthisis. Here the inference cannot logically be evaded that, if the hæmoptysis had not occurred, the lung-disintegration and death would have been escaped. But in what manner (conceding that no actual tissue-disease preceded the lung-infiltration with blood) did that blood produce the clinical results observed? Mere blood-infiltration will not produce such results; after pulmonary wounds, in the course of heart-diseases, in the course of certain aortic aneurisms, where blood oozes gradually into the texture of the lung, no phthisis follows. There must, then, at the least, be “predisposition” in the cases we speak of,—a predisposition locally represented, with much probability, by an ill-nourished fragile state of the pulmonary capillaries.

But there is a further question. How does the effused blood comport itself? What part does it immediately play in working out the eventual disintegration? Does it: (*a*) excite military tuberculisation in its neighbourhood; (*b*) entail irritative action around, ending in caseous pneumonia; (*c*) or undergo in its own proper substance cheesy metamorphosis? Either of the two former results is more readily admissible than the third; but the question is at the present hour undecided.

The quantity of blood brought up at any one time, varies between a few streaks and some pints of pure unimixed blood.

The tints in phthisical hæmoptysis vary,—venous red is rare, florid red most common: sometimes the sputum is of dark brick-red hue; again, of salmon colour, or of a light flesh-like pink.* Moulded clots, even of minute size, are excessively rare [616].

The mechanism of tuberculous hæmoptysis varies. In the excavation-stage it seems habitually caused, as shown in the elaborate essay of Rasmussen,† by bursting of aneurismal dilatations of small branches of the pulmonary artery coating the walls of cavities. In the softening stage, the coats of the capillaries doubtless undergo disintegration like the rest of the tissue-structures around. And, in the first stage, this latter mechanism may very probably occasionally hold also. But the very early hæmoptyses of tubercle remain anatomically unexplained: that the vessel-walls are mal-nourished, though, as we have just seen, very fairly probable, has not been actually proved.

1242. Although the breathing of phthisical patients range, as a rule, above par in frequency, positive *dyspnœa*, either objective or subjective, rarely holds a prominent place among the symptoms. Consciousness of obstructed breathing, when felt at all, commonly depends upon exertion of some kind. In the state of rest the frequency of respiration rarely reaches any notable height in the pure chronic disease; and when the act is morbidly accelerated to a serious degree, the pulse also beats with such increased frequency, that the ratio of the two suffers scarcely any change: I have not seen many cases of very marked dyspnœa, of which the patients volunteered complaints. In these instances there was, as a rule, either some organic cause, such as great emphysema, with bluish lividity of the face, and general coolness of surface, or pneumonia, to account for the symptom: or, it might be referred to neurosis of the vagna [936], or to hysteria. Still, I have known dyspnœa a very grave discomfort in phthisical males, where none of these explanations were admissible.

Hannover found that the absolute amount of carbonic acid, generated in the softening stage, increased with the number of

* Tagg, U. C. H., *Females*, vol. ix. p. 108.

† On Hæmoptysis. By Moore, Ed. Med. Journal, 1863.

‡ Dr. F. Smith has submitted the pulse-respiration ratio in phthisis to a most elaborate investigation (Med. Chir. Trans., vol. xxxix.); from this it follows that the average neither reached so high as 4:1, nor so low as to 2:3:1. It ranged lower in women than men. Pulsation was notably lowered, respiration increased, in frequency, by night; "the deeper the sleep, the more frequent the respirations."

respirations, while the relative amount (that which is contained in a definite volume of air), diminishes.

1243. Actual *pain*, or distressing sensations within the thorax, exists in the great majority of cases. But severe suffering of this kind is the exception: and hence one of the most obvious reasons, as a rule, why phthisical patients succeed so long in blinding themselves as to the dangerous character of their disease.

The pain may in part be intra-pulmonary [927], true pleuro-dynic, intercostal-neuralgic, or pleuritic. Local pleurisy is by far its most frequent tangible cause; to local evanescent dry pleurisies are in the main due the wandering chest-pains of these patients, and to more permanent pleuritic changes their comparatively fixed sufferings. But as already shown [755], the mechanism of pleuritic pain itself requires elucidation.

1244. (11.) *General and systemic symptoms.*—*Pyrexia*, sooner or later, becomes an invariable attendant on the progress of phthisis. Sometimes it arises coetaneously with the very earliest local symptoms; in sixteen of ninety patients observed by M. Louis, acute cases being carefully excluded, such was its time of origin. In the majority of cases it does not set in, until local irritative action is excited. Further I have known hectic fever in rare instances precede all local symptoms, but not all local signs.

The fever, of so-called hectic type, consists, in a complete paroxysm, of shivering, heat, and subsequent perspiration. But shivering is very rare; mere chilly sensations announce the onset as a rule. Habitually there is but one, an evening, paroxysm; there may be a morning one also. But total freedom from febrile action scarcely exists at any moment of the day,—and the real type is remittent.

The profuseness of the perspiration constitutes the chief peculiarity of phthisical hectic. Generally diffused over the whole body, or especially limited to the chest, neck, and head, these perspirations, commonest towards the early morning, are sufficient in some cases to drench the patient's linen and even the bed-clothes. Such sweating may occur independently of any previous subjective heat of skin. Sudamina are, on the whole, rare; their contents may, as in other diseases, give a neutral or even alkaline reaction, while the surrounding perspiration is sharply acid.

No direct ratio holds between the quantity of perspiration and the objective rise of heat: the former may be great, while the latter is but slight and *vice versa*. And again, while the thermo-

meter indicates steady elevation of temperature, night sweats may decrease, nay, absolutely disappear.

Acceleration of pulse, which may rise to 130 or 140 per minute, without proportional rapidity of breathing, but with elevation of temperature (the skin of the axilla or of the hand marking 100° or 102° Fahr.), and flushing over the malar bones, the whole attended with subjective heat in the palms of the hands and soles of the feet, mark the hot stage.*

Setting aside the period of actual pyrexia, the pulse small, sharpish, quick in its stroke, and habitually, but not invariably, frequent, is of wide range,—varying within my own observation, from 80 to 140 per minute in uncomplicated cases. The frequency sometimes varies remarkably in the same case within a day or two; occasionally an obvious cause, in the shape of some inter-current attack, can be found for the change,—quite as commonly it baffles explanation. It has been said that the increase of frequency on changing from the recumbent, to the sitting and standing postures is less than in other diseases attended with debility: the general statement seems not unfounded, but exceptions are too frequent, to warrant us in looking to the peculiarity for real aid in diagnosis.

1245. The patient's constant apprehension of chill, by interfering with proper ablutions, promotes (especially if he neglect free change of under-clothing) accumulation of an oily inspissated perspiration, and effete epithelium. Herein, it has been supposed, lies a favourable nidus for epiphytic growth; and unquestionably pityriasis versicolor is not uncommonly found on the front-chest of the lower orders of the consumptive population.† But as yet we are without any evidence, that the cutaneous excreta of phthisical persons *specifically* favour the germination of the epiphyte of that affection.

1246. The *digestive organs* suffer more or less in the great majority of cases,—but in the period of their seizure and in the amount of their suffering infinite diversity obtains.

The *tongue* may remain throughout (except under occasional disturbances, which might occur to a healthy person) perfectly natural in all its attributes. Marked furring is on the whole rare,

* Mr. S. Ringer has lately shown with precision, that the objective temperature begins to rise before the rigors of the hectic paroxysm set in. The quantity of urea and that of chloride of sodium secreted attain their maxima (not in exactly direct proportion) immediately before, and at the close of, the sweating stage. (Med. Chir. Trans. vol. xlii. p. 397, tab. xii.)

† Koch in Virchow's Archiv, 6d. x.

and generally traceable to passing hepatic disturbance. If there be any state of tongue that can fairly be called phthisical, it is the more or less vividly red, with large and irritable-looking papillae.

Thirst, even in apyrexia, is rarely absent through the whole course of the disease, whether the alimentary canal be free from anatomical change or not.

Failure of appetite, amounting sometimes to complete anorexia, occurs in an undetermined proportion of cases, and is of very varied, sometimes inexplicable mechanism. It may depend on chronic inflammatory disease of the gastric mucous membrane, on slow degenerative softening, on fatty atrophy of the epithelium;* or be purely dynamic. On the other hand, bulimia is occasionally observed in connection with neurotic dyspnoea, and may probably depend on hyperaesthesia of the vagus.

As long as the stomach produces digestive juices, these seem to be of good quality: at least chymification, whatever be the ultimate fate of the chyme, is often thoroughly and comfortably effected to the last. I have known the richest lobster-mayonnaises, truffles, mushrooms, and all conceivable varieties of so-called indigestible food, eaten without the slightest suffering to the final hours of existence. Though such digestive potency as this be confessedly exceptional, I have not, on the other hand, met with, in my own sphere, any marked illustration of the lamentable details concerning phthisical dyspepsia supplied by some authors. True, ordinary fat is sometimes ill-digested, and the phthisical stomach seems often to instinctively repel fatty materials of all kinds; but though more frequently noticed among tuberculously disposed people than others, this dislike for fatty matters is by no means confined to them [1831].

The secondary processes of digestion, chyle-formation, and hæmatosis, are those essentially at fault. Out of ordinary food the phthisical apparatus fails to evolve either chyle or blood of the natural qualities of health. The specific variety of this failure is, of course, peculiar to, and constitutes the intimate and essential manifestation of the tuberculous diathesis; in truth, some one or other failure of the species is an intrinsic element of the entire group of diathetic diseases.† The pathogenic problem, then, is to determine the nature of each specific failure. But while it is impossible to deny the ingenuity with which the idea has been worked,

* Admirably described by Dr. Handfield Jones. Vide also W. Fox, in *Med. Chr. Trans.*, vol. xli.

† Vide *Clin. Lectures on Reciprocal Influences of Diathetic and Acute Specific Diseases*, "Medical Times," June, 1855, p. 613.

to me, I confess, the day seems to be far distant, when we shall feel ourselves seriously called upon to recognise the inability to assimilate fat as the *primum mobile* of tuberculisation.

Pain and tenderness below the ensiform cartilage, with loss of appetite, nausea, and spontaneous vomiting, indicate sub-inflammatory action in the mucous membrane of the stomach, and can scarcely be considered direct symptoms of the primary disease. Vomiting of food, brought on by fits of coughing, and unaccompanied by any other gastric symptom, does not indicate any textural change in the organ: it is essentially mechanical. The phthisical stomach is, in truth, not readily nauseated, as a rule; observe, how it bears even rancid cod-liver oil,—and how little disposed phthisical persons are to grave sea-sickness.

Stomatitis, simple or diphtheritic, is not uncommon towards the close of the disease: epiphytic formation occurs, but rarely, in the exudation. Chronic pharyngeal abscess is in some instances met with,—in one case of the kind, that fell under my notice, produced by caries of a cervical vertebra, and assimilable in mechanism to so-called lumbar abscess.

I have twice known uncontrollable frothy *salivation* form a prominent and distressing symptom of the closing period, without obvious affection of the mucous membrane of the mouth or salivary glands.

In 1847, M. Fredericq drew attention to a *red streak at the edge of the gum* opposite the lower, and sometimes also the upper, incisors, as one of the earliest signs of phthisis,—the colour in highly febrile phthisis being brick-red, in hæmorrhagic phthisis blue. Subsequently he professed, that in the latter period of all chronic diseases a blue or red streak will be found. M. Vanoye, in turn, describes a white marginal line;* and Dr. Thompson insists upon the red. I believe with M. Fredericq, that the red line is to be found in a variety of chronic blood-diseases, but more frequently in phthisis than others. It may be completely absent, however, to the last hour (stage of the disease seems, indeed, to exercise no influence on its appearance); and is notably more frequent in patients of the lower than of the upper ranks,—a fact to be explained in some measure by habits of cleanliness and the reverse.†

* Ranking's Retrospect, vol. xii. p. 218.

† The want of real diagnostic significance of the red line here shadowed forth, has been subsequently demonstrated by Drs. Saunders and Draper from an examination of 451 individuals. The main results are as follows. Of 116 phthisical patients, 86 of 335 diseased, but not phthisical, persons, 257—of 37 healthy pregnant or recently delivered women, 32—presented the line more or less developed. (New York Journal of Medicine, 1867.) The authors have not investigated the effect of mercury, anti-

The *teeth* of phthisical people are said to be subject to transverse cracking, and to be of more than average transparency; but numerical evidence has not been furnished, and seems scarcely worth the seeking.

The state of the *bowels* varies greatly,—in some rare cases they continue natural, in a certain number constipated even to the last hour, in others relaxed from time to time, in a fourth class permanently loose. Diarrhoea may depend merely on secretive changes in the bowels, on small ulcerations in the ileum and jejunum, or on extensive destruction of the mucous membrane of the colon, as well as of the ileum. In the first case, the symptom is temporary, and easily controlled; in the second, more persistent, and with difficulty arrested; in the third case, absolutely unmanageable. In the last condition, as insisted on by M. Louis, the motions are very numerous, reddish, or putty-coloured, fluid, and of putrid odour. If the rectum be ulcerated, the motions may be pseudo-dysenteric. The connection of diarrhoea with chronic peritonitis will be considered by-and-by.

But, whatever be the efficacy of ulceration, as a rule, in producing diarrhoea, its innocuousness in this respect is in some cases equally certain. Not only may pretty extensive ulceration exist in the ileum without pain, either spontaneous or elicited by pressure, but with a confined state of bowels. Again, I have known, in a case running an acute course, marked abdominal pain and tenderness conjoined with obstinate constipation, where, after death, the bowels, in spite too of the frequent use of purgatives, contained abundant solid feces, and the ileum was extensively tuberculised and ulcerated.*

The symptoms of tuberculisation and ulceration of the cæcum and of its appendix are sufficiently obscure in the majority of instances. Tuberculous typhlitis may in fact, as I have more than once substantiated post-mortem, be completely latent. Ulcerative perforation occasionally occurs, more frequently in the appendix than in the cæcum itself. If the patient have already suffered from diarrhoea and abdominal pain, the occurrence of perforation may not be marked by any increase of suffering sufficient to seriously arrest attention: local peritonitis, followed by sacculated collections of pus, results. Or fatal general peritonitis cuts off the

mony, arsenic, &c., which, from some few observations at University College Hospital, seem to exercise a very distinct influence.

* Hudson, U. C. H., *Males*, vol. ix. p. 18. Even the large, as well as the small, intestines may be ulcerated and yet no diarrhoea exist. Thompson's case, *Lectures*, *Lancet*, lxx. cit., p. 579, vol. i., 1849.

patient rapidly. Or pus may filtrate into any one of the post-peritoneal sites occupied by intra-pelvic abscesses, and eventually discharge itself through the intestines, the vagina, the abdominal wall, &c.*

The *glands of Brunner* are sometimes enlarged and tuberculised: sub-acute duodenitis follows, and doubtless plays a part, though an uncertain part, in the phenomena of occasional dyspepsia.

1247. The *external lymphatic system*, on the whole, rarely undergoes tuberculisatio*n* in the phthisical adult. An antagonism, not absolute, but tolerably well marked, seems to exist between the external and internal tuberculisating processes. In corroboration of this, I have known the cervical and axillary glands, greatly enlarged in phthisical people, rapidly fall to the natural size without suppuration or symptom of any kind, while pulmonary tuberculisatio*n* as rapidly advanced.† Severe lumbar neuralgia may be produced by infiltrated glands pressing on the nerves; but, common from cancer, this is rare from tubercle. Disease of the mesenteric glands, which are tuberculised in from one-third to one-fifth of phthisical adults, takes part in perverting nutrition,—but in what form, and to what extent remains to be investigated. Mere obstruction of the lacteals is doubtless concerned; in cancer of these glands the lacteals may be seen plugged with stagnant chyle.‡

1248. The *bronchial glands*, often moderately enlarged by tubercle, itself quiescent or retrograde, rarely induce symptoms in the adult.

1249. The functions of the *encephalon*, in the pure disease, undergo less modification than those of any other organ. Cephalalgia, and perversions of cutaneous sensibility, if they occur, are purely accidental. Motor specific alterations are unknown; but irritability of the muscles, under the influence of percussion or other physical stimulus, is carried perhaps to a higher point in the emaciation of phthisis than of other chronic diseases.

Slight wandering at night, on waking out of sleep, sometimes occurs; with this exception the mental faculties retain their clearness in the majority of cases to the last few hours—trifling failure of memory, and inability to follow a train of thought, alone existing towards the close. Not only this, but the perceptive and reasoning powers sometimes acquire unwonted vigour and

* M. Leudet (Archives de Méd., 1859) has collected some interesting information on this subject.

† E. G. Petrolini, U. C. H., Females, vol. v. p. 175.

‡ Lucas, U. C. H., Females, vol. xvi.

acuteness, as the disease advances; and the imagination and fancy grow unnaturally vivid,—the individual becomes, as it were, idealised.*

In a word, when marked cerebral symptoms exist, they always indicate intercurrent disease.

1250. The *temper*, though irritable, is singularly hopeful. Every one has seen cases in which arrangements for future years are made within a few days of death; and I have actually known the question of a change of profession complacently considered within *three hours* of the fatal event. There may be, in such cases, an effort on the part of patients to deceive themselves and those about them, as to the real state of things: but, nevertheless, hopefulness constitutes a special clinical feature of the disease, and cannot by any means always be explained by the absence of pain. How strong the contrast between the phthisical and the cancerous patient in this point of view!

1251. The *subcutaneous areolar tissue* remains remarkably free, as a rule, from serous infiltration. If there be marked oedema even of the ankles, there is almost invariably some morbid state, besides phthisis, to account for the fact; *a fortiori*, if there be general anasarca of one or both lower extremities. Hope was, I believe, the first to draw attention to the occurrence of coagulation of the blood in the femoral vein, from mere sluggishness of current, towards the closing period of phthisis. The clotting process generally limits itself to one limb. I have but once had the opportunity of examining the limbs after death from phthisis, where anasarca and notable obstruction of the veins in a lower extremity had existed; in this instance, the femoral and iliac veins of the right limb were *inflamed* in the most positive manner.† I have, however, pretty frequently observed oedema of the legs, and twice of an *upper extremity*, disappearing rather rapidly under treatment, and unattended with any great tenderness in the track of the implicated veins. The oedema obviously occurred here independently of phlebitis; yet there was positive venous obstruction in the limbs,—a form of embolism doubtless produced by sluggishness of current, and altered constitution of the blood.‡

1252. *Pains in the lower extremities* are sometimes, towards the close of life, the prominent symptom, and may be of agonising

* For this phthisical acuteness of the faculties and exaltation of the emotional centre the ancients invented the term *catepsis*.

† Henry James, U. C. H., *Males*, vol. v. p. 130. 1850.

‡ The influence of heteremia is well shown by Mackenzie (*Med. Clin. Trans.*, vol. xxxvi.)

severity: if co-existent with anasarca, the state of the veins explains them; under other circumstances, especially, when the limbs are wasted and flaccid, they are inexplicable. It is easy, but scarcely satisfactory, to call them neuralgic: they do not follow the direction specially of the main nerves, but seem to occupy the entire substance of the limbs. Possibly they may depend on hyperæsthesia of the vaso-sensory system.

1253. The *osseous system* has scarcely been studied in the phthisical with necessary care. Tuberculisation of the lumbar vertebrae, more rarely of the cervical or dorsal, giving rise to a peculiar form of caries and abscess, occurs in a very small proportion of cases. I have never met with tuberculous periosteitis; but occasionally inflammation, secondary to the deposition of tubercle in the meshes of the endosteum, occurs in the heads especially of the long bones.*

Whether the nutrition of the osseous system of the tuberculous adult undergoes any specific form of impairment, seems to me yet open to inquiry. The bones, like the soft parts, are certainly deficiently nourished; but I have never met with positive osteomalacia in fully grown phthisical persons.

Rufz, of Martinique, earliest threw serious doubt on the long-accredited doctrine of the identity of rickets and scrofula. Tuberculisation and rickets are very assuredly rare co-existences; and several modern observers (some on the ground of the extreme rarity of tubercle in rachitic children, some for the less convincing reason, that much rachitic chest-deformity must produce venosity of the blood, a crasis antagonistic to that of tubercle), reverse, *in toto*, the notions of our forefathers, and maintain the diseases to be reciprocally exclusive. I have seen mesenteric, bronchial and pulmonary tubercle in a rachitic child,—the two affections, that of the bones and that of the soft parts, appearing to advance, unmodified each by the other's presence. But on the whole, the diathetic essences of tubercle and rickets seem different,—their combination purely accidental, as matter of experience uncommon, and of inference unlikely.

1254. *Emaciation*.—(a) Emaciation ranks among the most constant and most striking phenomena of phthisis. The alterations in the adipose tissue are the same as in other forms of emaciation,—the cells diminish in size, oil gives place to watery fluid, and crystalline separation of the fat-elements takes place within them.

* The tibia, Univ. Coll. Museum, Wax Models, No. 2909.

Inasmuch as emaciation precedes in a fair share of cases all other local or general symptoms, it becomes obvious that the presence of tubercles in the lungs (or the constitutional state, of which those tubercles are the local expression), acts *per se* as an efficient cause of wasting,—loss of appetite, vomiting, diarrhoea, and perspirations, are subsidiary in their influence. The agency of the tuberculisng process, in this respect, is not the less real, because in the existing state of knowledge it eludes explanation. The dislike of tuberculous people to fat, whence absorption of their own adipose substance as aliment for respiration ensues, can scarcely be accepted as an hypothesis clearing up the mystery; inasmuch as similar waste, prior to the occurrence of colliquative symptoms, is often observed in cancerous sufferers, who display no special dislike to oily food.

It is not only the external fat and cellular tissue that waste: the muscles, and the parenchymata suffer too; as proved by Louis and Bizot, the weight of the heart and calibre of the aorta are less in the victims of phthisis than of any other disease, except cancer. The weight of the body, as a whole, consequently diminishes, rapidly, surely, and progressively, more especially as no serous accumulations form to give fictitious bulk. But there is a curious fact connected with the emaciation of phthisis, and, for aught I know to the contrary, of other chronic diseases; namely, that it is not an invariably steady process. I have repeatedly found, by placing patients in the balance within short intervals, that there are rises and falls in weight, intercurrent to the general progressive tendency downwards, and occurring irrespectively of any obvious changes in diet, appetite, or colliquative symptoms. The late Dr. Robert Williams, of St. Thomas's, as I several years ago learned from his friend, Dr. Silvester, inferred from a large mass of observations upon this point, that there was a law of periodicity regulating the rises and falls of weight. I have no means of ascertaining what the period established by Dr. Williams was; and my own observations are too limited to supply the deficiency. I feel tolerably sure that the interval is shorter than a month—the period at which Sanctorius, generalising from experiments on his own person, inferred that a passing increase of two pounds' weight (ascribed to lunar influence!) took place in health.

The thoracic coverings waste most, the facial fat least, rapidly; exceptions to this rule are very rare. As a fact of probably similar import, I may mention that I have occasionally seen the hair on the chest of phthisical males uniformly and perfectly white, while

as yet but a few "silver threads" exhibited themselves on the head, and in the whiskers.

(b) Such is the ordinary course of things. But in some instances phthisis runs its course almost to the end without notable emaciation: the body may be plumply fat, while large cavities exist at the apices, and the disease makes rapid advance downwards. Such retention of fat generally indicates a sound state of the alimentary canal; still I have known plumpness maintained with feeble appetite, and occasional diarrhoea.* On the other hand rapid emaciation may take place in persons eating abundantly, and free from a trace even of dyspepsia.

And, again, the mass and firmness of the muscles may increase, while the disease advances, if the patient be in the habit of using gymnastic exercises.

(c) There is a third aspect under which emaciation may be considered. Does loss of fat and muscle ever precede the local pulmonary disease absolutely; and so constitute the first appreciable result of the intimate nutrition-vice—whatever this may be—of the tuberculisng process? Certainly cases do every now and then occur where loss of weight, attended or not with slight pyrexia, gives the first inkling of the mischief that by-and-by grows patent. But conceding, as is the occasional fact, that no physical signs can, under these circumstances, be given, proof fails that their efficient cause in the shape of miliary granulation or crude tubercles may not be present.

1255. *Bulbousness of the finger-ends*, curvation and transverse cracking of the finger-nails, and falling of the hair, are observed in a certain share of cases. I have not found, as it has been asserted, that the habit of biting the nails is specially common among the phthisical.

1256. Louis has arrived at the conclusion, contrary to what had previously been held, that the *sexual appetite* in the male undergoes impairment.† Menstruation, he found, ceased in females, in whom the total span of the disease fell short of a year, at about the middle of its course; when the disease ranged in duration between one and three years, the catamena continued commonly to appear till the final third of the period was reached. Menstrua-

* J. Conner, Females, Consumption Hospital, Chelsea. This patient retained flesh long after excavations had formed, until Bright's disease, which rapidly destroyed her, supervened.

† Albers (Beobachtungen, 2r Theil, S. 95, Bonn, 1838) assuming the "frequent" existence of increased activity established, accounts for it by tuberculation of the vesiculae seminales. But Louis found these parts tuberculous in but 3 of 40 bodies.

tion, while existent, may retain all its natural attributes; or disturbances in point of time, quantity, and quality, may occur. The uterus and ovaries present no deviation from structural health, as a necessary condition of phthisical paramenia. Neither is it possible to explain, by the course or predominant symptoms of the disease, the healthy or perverted state of the catamenial function.

It has been generally supposed that *pregnancy* retards the progress of phthisis,—the disease acquiring increased activity after parturition. I have positively observed several cases in which many of the symptoms of phthisis became less prominent during pregnancy. This might be the fact, it is true, without the real pulmonary disease being suspended in progress: but it is curious that I do not remember to have opened, or to have seen opened, the body of a female dying of phthisis, and at the same time pregnant. M. Grisolle has lately examined these questions, and comes to the conclusion, that the disease is somewhat increased in rapidity of progress during pregnancy; while after parturition, it is slightly mitigated, or, at least, remains stationary. The number of cases he has collected (and all other persons that I know of are in the same predicament) are quite insufficient to solve the problem.

I some time since numerically examined the question, whether the tuberculous diathesis intensifies or weakens the force of fecundity in the female, and of the procreative faculty in the male, and was led, by the facts, to the conclusion, that *the procreative power of phthisical males is below the average—the fecundity of phthisical females materially above it*. Taking the two sexes together, and regarding them as phthisical stock prepared to propagate, the female activity is counterbalanced to a certain extent, though by no means completely, by the male inactivity; 11·82 years of phthisical cohabitation produced a mean of 0·83 children less than 17·48 years of non-phthisical cohabitation.*

Spermatorrhœa occasionally occurs in phthisical persons; either in moderation, as a result of continence; or to a grave amount, as the effect of dissolute habits. The qualities of the seminal fluid, it may be inferred from the facts concerning male procreative power just referred to, are in the mass of cases in some way defective.

* For the facts themselves, *vide* Medical Times, July 6, 1850. The above results accord with M. Louis's general statement, concerning the failure of sexual vigour in the male; they are totally at variance with an assumption of M. Grisolle, that conception is rare in phthisical women. The total number of cases on which my inferences are founded, is 91 of phthisical, 220 of non-phthisical, persons.

But the statement of Davy,* that spermatozooids cease to be formed in chronic diseases, of fatal character, clashes with direct observation. In sixteen *aged* persons, cut off by chronic disease, three of them by phthisis, spermatozooids were found by M. Duplay.†

1257. The *blood* in the early period of phthisis is deficient somewhat in red corpuscles, and very slightly in fibrine; the proportions of albumen and water are increased; the serum appears to be less alkaline than in health. With the advance of the disease the blood becomes hyperinotic, presumably from the irritating influence of the tubercles and intercurrent inflammations. Quite at the close the fibrine and the solids generally undergo notable diminution. There is no microscopical character, that I know of, in the red corpuscles, which can be trusted to as the slightest guide in the diagnosis of the disease. In a word, if there be really any distinctive quality in the blood when tuberculation is impending, or has actually been achieved, it is unknown.

The alleged presence of the *polystoma sanguicola*, in phthisical blood, must be looked on as exceptional.

1258. In the early stage, when the local symptoms are inactive, and notable fever absent, the *urine* presents no seriously abnormal characters. When the pulmonary texture breaks up, with marked attendant pyrexia, the urine becomes small in quantity, of strong odour, deep urinous colour, and of high, or rather high, specific gravity,—1022 to 1028. If the system be impoverished by great loss of blood, or colliquative drain of any kind, the secretion becomes pale, watery, and of low gravity. As a rule, in the active disease, the uric acid ranges more or less above the average of health. Temporary increase of urea may occur; but even where waste of tissue is rapidly going on, and the patient takes nitrogenised food in good quantity, the daily average may range at about forty or fifty grains,‡—Lehmann's average for a healthy male adult, feeding on mixed animal and vegetable diet, amounting to 32·5 grammes. Oil globules are very rarely to be found in phthisical urine; I have never detected them, except where the patient was taking cod-liver oil. Albumen sometimes appears passingly in minute quantities, either probably from indigestion,

* *Elinb. Med. and Surg. Journal*, 1838.

† Quoted by Reubaud, *de l'Impuissance*, t. ii. p. 605.

‡ This would tend to show that the muscular destruction is relatively low. When the wasting process may fairly be supposed to fall specially on the actual sarcois substance, as in cases of irregular convulsive action, chorea or other, the amount of urea, as I long since showed (*Clin. Lectures*, "Lancet," January 27, 1849), may undergo very material increase.

or renal congestion. In a certain proportion of cases, all the symptoms of Bright's disease supervene. Simple pyelitis, with acid urine, deposit of pus, and of casts of the tubuli, with such amount only of albumen as is referrible to the liquor puris present, occurs in rare instances; in yet rarer the evidences of tuberculous pyelitis, as proved after death, may be obtained during life.* The urine occasionally contains minute quantities of sugar,† a fact interesting in connection with the well-known tendency of glycohemina (saccharine diabetes) to terminate in phthisis. On first thought, the existence of so readily oxidisable a product as sugar in the urine, would seem subversive of Liebig's hyperoxidation theory of phthisis; but the fact that in saccharine diabetes, gum and alcohol are completely oxidised, while sugar is not, shows that an elective power of oxidising some, and not all, oxidisable materials, exists in the economy. Sugar may be, and commonly is, totally absent from the urine in the most advanced cases of phthisis.

Micturition is of natural frequency; but female patients, even while yet young, are often tormented by slight involuntary expulsive discharge of urine during fits of coughing. The resistance of the sphincter vesicæ seems enfeebled, and mechanical forcible expulsion results.

1259. (III.) *Incidental Symptoms*.—The incidental symptoms of phthisis are the clinical expressions of its "secondary morbid changes." A case of phthisis may run its course without a single one of these ever occurring, or they may appear in various combinations and with variable intensity. Sometimes these symptoms are so severe as to throw into the shade those of the pulmonary disease, and monopolise the attention both of patient and physician. The secondary anatomical changes causing them, sometimes seem to accelerate, sometimes on the contrary to retard, the advance of the primary affection; they may even themselves prove the real causes of death.

1260. *Pneumonia* frequently occurs in the course of tuberculous disease, or at its close. In the former case, it is either a mere local effect of the progress of tuberculisation, or it may be exten-

* Wright, U. C. H., *Females*, vol. viii. p. 195. "Deposit in urine: pus-corpuscles, oct-globules, amorphous granular organic matter, cells larger than blood-discs, smaller than pus-cells, with granular contents, somewhat irregular and angular outline, and showing no nucleus under acetic acid." One of the pyramids, infiltrated with tubercle, had ulcerated into the renal pelvis, which contained 1 oz. of pus and tubercle detritus.

† Arthur, U. C. H., *Females*, vol. vi. p. 51; Feb. 1851. First stage of phthisis passing into second: specific gr. of urine = 1024; weight of patient = 8 st. 3 lbs. on Feb. 19; = 8 st. 8½ lbs. on March 20, when the sugar had disappeared, the patient having meanwhile taken oleum morrhue in small doses.

sive, and acquire almost the importance of an idiopathic attack of the disease. But even then it is rarely of serious augury: it is, singularly enough, less fatal than primary pneumonia. What I have observed on this head is in perfect accordance with the observations of Louis;—the mean duration of the inflammation, even, is less than when occurring in sound lungs. Some of the most marked examples of rapid resolution I have met with, were in phthisical persons.

Louis holds that pneumonia occurring at the closing periods of phthisis, is almost of necessity fatal. But, admitting this, it does not follow that there is any excess of special tendency in the phthisical to death by pneumonia. In point of fact, pneumonia—or conditions of the lung referred to that disease—is a tolerably common appearance in the lungs of persons cut off with all varieties of chronic maladies. The proportion of cases in phthisis is scarcely greater; and where so-called hepatisation is found, it has not always been the actual cause of death.

Pneumonia limited to the *anterior* portion of either apex, is, in the great majority of cases, tuberculous,—not invariably so, however. I have known pneumonic signs limited to the infra-clavicular region, independently of local tuberculous irritation, so far as the eventual disappearance of all vestige of morbid conditions at the apex can be accepted as proof of such independence.

1261. *Pleurisy* we have already met with in the dry and exudative forms, as an attendant on tubercle. Effusion occurs in a fair proportion of cases, and is always a most serious complication: complete recovery is singularly rare; and, in truth, effusion, single or double, not unfrequently hastens the fatal issue.

1262. *Bronchitis*, local or general, invariably occurs in the course of phthisis. The form most peculiar to the disease seems to be that limited to one apex or to one base.

1263. *Ulcerations of the epiglottis* give rise to great dysphagia, especially of liquids, which frequently return by the nostrils. There is fixed pain opposite the affected part. No serious swelling of the soft parts around the larynx occurs; and I have never met with any notable discharge of blood from this source.

1264. *Chronic inflammatory changes in the larynx*, in rare instances connected with local tuberculisation, are indicated by change in quality of the voice and cough, which grow hoarse, muffled, and cracked; and in proportion as ulceration destroys the chordæ vocales, the voice degenerates into a hoarse whisper. I have never observed absolute aphonia. Pain, stinging, pricking,

or shooting, is more or less constant; and a distressing sensation of dryness is experienced. If the epiglottis be free, there is either no dysphagia, or but very trifling difficulty in swallowing. The physical signs are rough, coarse respiration in the larynx, with sonorous, sibilant, or thin gurgling rhonchus, according to the dryness or moisture of the diseased surfaces.

1265. I know of no positive symptoms of *ulceration of the bronchi*; those of *chronic tracheitis* are obscure. Pain, heat, and dryness, with choking sensation above the sternal notch, are all that I have observed; and these symptoms may exist without tracheal ulcers, while ulcers may exist without them. Intense, so-called "tracheal dyspnoea," must be at the least singularly rare. I once saw perforation of the trachea occur with consequent subcutaneous emphysema.

1266. The symptoms of *perforation of the pleura* are elsewhere described [896]. The perforating process, instead of inducing pneumothorax in the ordinary way, may make a passage through the previously adherent costal and pulmonary pleurae to the integuments of the thorax. Eventually the skin may be perforated; whether it gives way or not, subcutaneous emphysema may, or may not, ensue.

1267. Of abdominal incidental symptoms, those indicating *chronic peritonitis* are the most important. Enlargement of the abdomen, pain and tenderness under pressure, ascites, and tympanitic distension of the intestines, are the prominent symptoms. The ascites may rapidly disappear under treatment, while the tympanitis remains, and the outline of the intestines appears on the abdominal wall. Pain may be constant, or occur only at the moments flatus moves in the bowels. All control over escape of flatus may be lost; probably, by a consensual arrangement for the avoidance of pain, the effort, necessary for its retention, is omitted. Diarrhoea is present in the majority of cases, whether the bowel be ulcerated or not.

This secondary affection, grave though it be, may fall into a quiescent state; but if so, the pulmonary disease almost unfailingly grows more active.

Or, as it has once occurred to me to witness, the chronic mesentero-peritoneal affection may suddenly become acute, and circumscribed accumulation of pus occur. Pointing outwards, in the instance referred to, this collection was lanced; discharge continued for a time, and eventually ceased, while the patient recovered, temporarily at least, flesh and strength. Remarkably

enough, too, the coexistent pulmonary affection underwent no coetaneous increase of activity.

1268. *Fatty disease of the liver*, not a very common secondary change in this country, has no special symptom that I know of. It certainly does not give rise either to ascites or to jaundice. Probably it affects the properties of the faeces. Its physical signs are those of simple, smooth enlargement of the organ.

1269. *Fistula in ano* is, according to my observation, more frequently met with, in males especially, than it has of late been the habit to believe.

1270. Serious as are the evils of ulcerations of the bowels, those of *cicatrisation* may be more so: death may, in fact, be the result of accompanying contraction of the bowel. M. Louis reports a case, where the effects of intestinal stricture, the earliest indications of disturbed health, observed by the patient, proved fatal in about twenty-two months, having throughout kept the chest-symptoms in abeyance, though cavities existed in the lungs.

1271. Occasionally phthisical patients suffer from *tænia solium*: but the relationship seems purely accidental.

1272. Tuberculisation of the *vagina, uterus, Fallopian tubes and ovaries* produces no distinctive symptom: the existence of a peculiar form of leucorrhœa may prove its sole evidence. When the vagina is coated with soft tuberculous deposit, this may readily be removed for examination, so as to place the nature of the affection beyond a doubt. Grey milary granulations may form acutely in perfection in the lining membrane and body of the uterus during the *post-partum* month, and aid in rapidly destroying life.

Tubercle very rarely occurs in the *male genital organs*. It has, however, been found coating the urethra of phthisical patients;* never in the structure of the penis, so far as I know. The prostate may be expected to be tuberculous in about one-thirteenth of fatal cases of phthisis,†—in exceptional instances the *vasa deferentia* and *vesiculæ seminales*. In fourteen cases of prostatic tubercle, collected by Sir H. Thompson,‡ the same disease existed, at least, eleven times in the kidney, and six times in the testicle. The symptoms of prostatic tubercle are not distinguishable from those of simple enlargement,—the tuberculous deposit may *soften* and “*abscess*” ensue.

Of the influence of tuberculisation of the testicle on procreative activity, nothing is known but by conjecture.

* Louis on Phthisis, 3rd. Ser., ed., p. 118.

† The Enlarged Prostate, chap. 11.

‡ Mem., p. 113.

1273. *Tuberculous meningitis*.—The existence of tubercle in the meninges discloses itself solely through inflammation of the textures in which it is seated.

The symptoms of tuberculous meningitis in the adult scarcely bear the division into stages, so distinctly to be recognised in the child: still, as Lediberder and Louis have admitted, three stages may occasionally be traced.

(a) Cephalalgia, most commonly frontal, vomiting, alternate flushing and pallor of the face, followed by delirium, of the quiet kind, very rarely boisterous or violent, are commonly the earliest indications. At the same time the chest-symptoms abruptly improve or actually disappear,—while both pulse and respiration slacken, and the skin becomes relatively cool. I have now observed at least six cases of this affection in the adult, in which a peculiar form of mutism formed a striking, and sometimes the very first, symptom. The patients, when questioned, looked steadily in the speaker's face for a few moments, and then, without making the slightest effort at speech, deliberately, but without any sign of petulance, turned their heads away. Whether this mutism be of intellectual, emotional, or muscular mechanism, is open perhaps to discussion; the first of the three seems by far the most probable. Theoretically it might rather be supposed to be a dependance on the seat than on the nature of the disease; yet as matter of fact I have only observed it in tuberculous meningitis. Photophobia and intolerance of sound rarely occur to any marked amount.

(b) As the disease advances, stolid expression of countenance; somnolence alternating with wild delirium; obtuse, but not annulled, sensibility; partial, rarely hemiplegic, motor paralysis; and contraction of the pupils, set in. The pulse becomes very irregular. Partial clonic or tonic spasms, facial and other, even sharp convulsions, may occur,—ushering in the final stage.

(c) Persistent pallor of face, filmy conjunctivæ, dilated pupils; strabismus, distortion of the features; a motionless state of the body and involuntary discharges, mark the further progress of the disease,—somnolence passes into fatal coma, or a fit of convulsions abruptly terminates existence.

Such is the ordinary course of the affection; it may commence, however, without previous distinct warning, by severe convulsions.* Remission of the cerebral symptoms, simulating conva-

* Reynolds (*Diagnosis of Dis. of the Brain*, p. 79) has noted an instance of such form of commencement.

lescence (though I have never seen it so marked in the adult as in the child), may occur towards the fatal issue, which generally takes place in from seven to eighteen days. Whether recovery be possible, will be considered under the head of Treatment.

1274. The development of tubercle in the actual substance of the *encephalon* or *spinal cord* of the phthisical adult is exceedingly rare. The symptoms are those of tumor in the nervous centre implicated. The only guide to the distinction of the *nature* of the tumor is to be found in the manifest presence of pulmonary tubercle. But this guide will fail sometimes; for tubercle may exist as a chronic development in the brain or cord of a non-phthisical adult (*vide* also ACUTE PHTHISIS).

Fatal *paraplegia* of rapid course may be caused by a very small amount of tuberculous deposit in the medulla.*

1275. *Deafness*, eventually traced to tuberculous destruction of the *membrana tympani*, has been noticed among the rarest class of symptoms.

1276. The *sight* of phthisical patients remains, as a rule, clear to the last; there is obviously no change in the condition of their blood, assimilable to that which in saturnism, scurvy, and Bright's disease, leads to impairment or complete loss of vision. Amaurosis in a phthisical patient would suggest, as a strong probability, the presence of a tuberculous mass within the cranium.

Some twenty to thirty tubercles, varying in size from a pin's head to a millet seed, were found by Soelberg Wells in each choroid coat of a female whose sight was good: there was no choroiditis.

Although popular opinion somewhat exaggerates both the frequency, and the amount, of the glistening brilliancy of the tissues of the eye-ball, there is no doubt of its real existence in a certain share of phthisical persons. On what the peculiarity depends is uncertain; but, when well defined, it is not without diagnostic significance.

1277. The period of the primary affection, at which secondary morbid changes and their clinical effects become obvious, varies widely. The appearance of some one or more of the group may be almost simultaneous with the outbreak of the essential disease; or life may be quasi-extinct, at the moment when secondary phenomena occur for the first time,—simply, as it were, to precipitate

* For instance, by two tubercles, one as large as a small pea, the other as a pin's head, in the grey substance of one half of the cord in the mid dorsal region. (Hewitson, U. C. H., *Females*, vol. xvi. p. 63.)

the fatal issue. This statement holds good of each secondary state in particular. Thus perforation of the pleura may actually afford the first unmistakeable evidence of pulmonary disease, or (the patient having been tuberculous for years) precede his death but by a few hours. Laryngeal symptoms may at the very outset take the lead in importance, mask the pulmonary sufferings, and even modify the thoracic physical signs; or the voice may remain firm to the closing hour.*

STAGES.

1278. To the three stages, ordinarily admitted, of *deposition*, *softening*, and *elimination*, some would prefix a fourth under the title of "premonitory," or "true first" stage.† Failure of strength, loss of fat, constitutional erethism, and raised temperature are the exponents of this stage; but it is now, and probably will long remain, a moot question, whether these conditions precede, attend, or follow actual deposition. Meanwhile the laws of general pathology justify us in accepting them as effects and not precursors.

COURSE.

1279. The mode of progression, or the Course, of phthisis, varies exceedingly in different cases. Five principal varieties may be established: *steadily progressive*, *remittent*, *intermittent*, *retrogressive*, and *latent*. Of these the last only need be considered here; the *retrogressive*, the most interesting of the group, will, by-and-by, be examined apart.

1280. *Latent course*.—Chronic phthisis may, especially in females, for a portion or for the entire of its course, whether this be of medium or considerable duration, remain symptomatically latent. That is, tubercles may exist in the lungs, and slowly work out their ill influences on the organism, through secondary blood-changes, without awakening attention by any of their ordinary local thoracic symptoms, such as cough, expectoration, pain in the chest, and dyspneæal sensations.

Four classes of cases may be met with referrible to this head. (a) To the first belong instances in which violent hæmoptysis, or perforation of the pleura, are apparently the initial symptoms of the disease: hæmoptysis by no means rarely, perforation very very seldom, bears this relationship in point of time to the other effects

* It is tolerably well known that within the last few years we have had a distinguished contralto and an excellent soprano still singing at Her Majesty's Theatre, while the excavating process advanced in their lungs.

† First Stage of Consumption, by W. Dobell, M.D. 1867.

of the disease. (b) To the second belong cases of slow course in which one of the secondary morbid states, such as chronic peritonitis, or ulcerative diarrhoea, masks, or really suspends, the progress of primary mischief. (c) In a third category we find cases, where an individual is generally out of health, without suffering from local or general symptoms of any severity. (d) In a fourth rank instances where very prominent symptoms exist, such as emaciation, fever, loss of appetite and sleep, with recurring diarrhoea,—none of them of obvious pectoral origin.

The local latency of tuberculous disease in some of these cases seems explicable on the principle of *Duobus morbis simul obortis, celerior obscurat alterum*. But in instances where none of the secondary morbid states exist, the fact baffles explanation. The great points for the observer to bear in mind are, that, while such latency is not only a real, but a frequent, clinical fact, physical signs alone can disclose the true state of things. A single tap above the clavicle will give the ready clue to much that has hitherto proved utterly mysterious. Let him not be diverted from his belief by the assurances of patients that they have never coughed,—the assurance will occasionally be given by persons who, at the moment they give it, have *cavities in their lungs*. But unfortunately cases every now and then arise, in which the physical signs themselves want the necessary distinctiveness to justify the diagnosis of tubercle. Under these difficult circumstances the expectoration may be applied to in aid,—the spirometer can merely show more precisely, what will assuredly on other grounds prove indubitable, that respiration is shallow and non-expansive,—the balance can only give the measure of a reduced bulk that is patent to the eye,—the thermometer only estimate the degree of an obvious pyrexia. The family history may lend great aid,—but it may also help to deceive.

An all-important truth is that under conditions favourable to the general health, all the outward evidences of notable improvement may arise, at the very moment local disease is advancing at a rapid pace. This is one form of effect sometimes produced by change of climate.

MODES OF RELATIONSHIP OF PHTHISIS TO OTHER DISEASES.

1281. The attractions and affinities of pulmonary tuberculisation on the one hand, its repulsions and antagonisms on the other, a subject opening up a vast field for study, cannot be wholly passed over even in a specially clinical volume. Accordingly, an attempt

is provisionally made in the following table to express the chief of these relationships. It must be remembered there is no absolute antagonism, and no absolute attraction, in *any* case. In order to avoid needless subdivisions, the table is so constructed that phthisis must be considered to stand, in some instances, as antecedent, in certain others as consequent, in the order of antagonism: that is, phthisis prevents the development of some of the morbid states named, while some of these *per contra* play the same obstructive part in regard of phthisis.

		ACTIVE PHTHISIS.	
		<i>More or less antagonistic diseases.</i>	<i>More or less attractive diseases.</i>
(A) Specific diseases		Variola?	Vaccina?
		Typhoid fever?	Typhoid fever?
		Cholera Asiatica.	Influenza.
		Yellow fever.	Syphilis?
		Ague.	
(B) Diathetic diseases	I. Of blood origin	Carbonaceous disease [626].	
		Cytemia.	Leucœmia?
		Leucœmia?	
		Spœmia?	
		Rickets [1253].	
	II. Of nervous origin	Calculus diathesis in general.	Glycœmia.
		Gout.	Fatty diathesis.
		Cancer [1377].	Ulcerative diathesis.
		Diathetic skin diseases, e.g., chronic pemphigus.	"Bright's disease"
		Chronic alcoholism?	
(C) Local diseases		Hysteria.	
		Emphysema [1030].	
		Nodular pulmonary apoplexy [1202].	Pulmonary inflammation.
		Active organic cardiac disease [1234, 6].	Insanity.
		Angina pectoris.	
		Aortic aneurism.	

The majority of the relationships thus tabulated are individually touched upon in various parts of this work; a few of them may be more specially considered here.

1282. (A) (a) Rilliet and Barthez maintain that small-pox and tubercle repel each other, and that vaccinated children are more disposed, than those non-vaccinated, to tuberculisation. They give the subjoined table:

Of 203 vaccinated children -	Of 93 non vaccinated -
138 died tuberculous,	36 died tuberculous,
70 „ non-tuberculous.	65 „ non tuberculous.

These facts are too few in number to command assent to the grave conclusion they directly supply. On the other hand, the

attempt to prove from the Bills of Mortality of a century ago, that small-pox is an active cause of tuberculation, seems to me to indicate an amount of faith in the diagnostic precision of our forefathers, scarcely warranted either by direct evidence, or by inference from a fair estimate of the acquirements of observers of the present day.

(b) The rarity of active tubercle in the victims of Asiatic cholera and of yellow fever, flows obviously from post-mortem examinations. Typhoid fever rarely occurs in the actively phthisical; but destruction of lung, possibly tuberculous, seems excited by that species of fever.

(c) The question of the possible antagonism of ague and tuberculation seems to have been started by Sir John Sinclair: * his facts bear mainly on the increase of phthisis in districts formerly, but no longer malarious. To Dr. W. C. Wells,† however, belongs the merit of earliest placing the doctrine on a firm basis: his paper, of remarkable originality, has apparently served as the germ of many a subsequent essay. Among recent writers, J. C. Boudin‡ stands out, as by far the most painstaking and logical of those who have given in their adhesion to the dogma of Wells.

The reality of this form of antagonism has been questioned; but the total mass of opposing evidence seems to me to do no more than prove (what, as a general pathological law, is incontestable), that the antagonism is not absolute. Much has been made of errors of diagnosis; but in the existing state of knowledge these must form an insignificant item,—and yet at the present hour, Lincolnshire for instance, one of the bleakest and most exposed counties in England, supplies but a low phthisical mortality, while it is also one of the rare districts in which malarious fevers yet linger among us.

A review of the attainable evidence appears to me to warrant our accepting the following propositions:

1. In marshy districts phthisis and intermittent fevers are frequent in the inverse ratio of each other.

* Quoted by Wells *Op. infra cit.*

† Observations on Pulmonary Consumption and Intermittent Fever, chiefly as diseases opposed to each other, &c. (Trans. of a Soc. for the Improvement of Med. Knowledge, vol. iii. p. 471 1812.) Dr Wells worked in accumulating evidence for twenty years before committing his thoughts to print. It may be well to mention that he is the real parent of the doctrine, that ague and continued fever are antagonistic, *loc. cit.* p. 515.

‡ *Études de Géol. Méd., &c.*, Paris, 1845. The idea, however, appears to have suggested itself to M. Boudin in the first place, from observing the rarity of pulmonary mischief among French soldiers toiling and squatting in the mud of the marshes of Navarino.

2. Phthisis appears scarcely to occur in paludal regions, except among imported families.

3. Children born in a marshy place lose the benefit of the paludal poison, and of any inherited malarious impress, by being sent away, as they sometimes are, for the purposes of education.*

4. The exemption from phthisis seems to hold good, directly as the intensity of the marsh-poison.

5. In drained malarious places ague disappears; phthisis, new to the local pathology, appears;† the *experimentum crucis* has been made by restoration of the marsh, when the old fevers have recovered the place passingly usurped by the new phthisis.‡

6. In many malarious districts the women only become phthisical,—they do not work in the marsh, and are relatively little exposed to the influence of the poison.

7. When phthisis does occur in malarious districts, it runs a slower course, *ceteris paribus*, than elsewhere.

8. There is evidence quite strong enough to awaken attention to, if not to carry conviction of, the probable curative influence of malarial air on imported phthisis [1607].

9. In excessively malarious inter-tropical districts persons, constitutionally predisposed to pulmonary disease, have been found the most healthy.§

Malaria then, appears to generate a condition of blood in great measure incompatible with vigor of the tuberculous diathesis. There is nothing *primæ facie* inadmissible in the notion that a poison (let it be, as surmised at the present day, composed of vegetable spores,—the reign of chemical theories having for the moment at least passed away) reaching the blood, shall so modify vital acts, that the intrinsic vice of nutrition, essential to phthisis, shall cease to be a possible existence. As to the permanence of the antagonism; once put in play, malarial influence is known to abide in the system for a long life-time, though no renewal of the poison shall have taken place since early youth.¶

* Pascoe in Bondin, loc. cit. p. 42.

† Drake, *Principal Diseases of the interior valleys of North America*, vol. 1.

‡ Green, *Report on Sickness in U. S. Army*. Washington, 1810.

§ Copland, *Dictionary of Med.*, vol. 1. p. 553. 1837.

¶ And in point of fact the permanency of such influence, once established, is, in the present state of knowledge, constant. Look at the permanency of blood diseases once impressed on an individual, and transmitted generation after generation. What a field for speculation on the analogies and on the activity of impressions, once made deeply on the blood and nerves, is afforded by the oft-cited history of Lord Morton's seven-eighths Arabian mare that, having been once covered by a pacer in 1815, gave birth, in due season, as might have been anticipated, to a hybrid foal; in 1817, 1818, and 1821, having been covered by a black Arabian horse, successively produced three foals, all of which bore the zebra-like marks of their long-past quagga. Facts,

1283. (B) (a)—What precise part saturation of the system with alcohol plays in regard of the liability to pulmonary tubercle, cannot be said to be as yet satisfactorily determined. Drs. Jackson* and Peters† infer that chronic alcoholism exercises a prophylactic influence; the former observer found tubercle in the pulmonary tissue of only five among 35 persons known to have been intemperate in life; the latter in the post-mortem examination of the bodies of "nearly 70 persons," dying suddenly or found dead in the streets, and who had been known drinkers, detected no single instance of actively softening tubercle, but some samples of crumbly tubercle, and "cicatrices" with crude tubercle. The apparent bearing of these facts undergoes some modification under the sharply critical scrutiny of Dr. John Bell;‡ but I confess the documents, cited by this laborious inquirer in turn, fail in my apprehension to wholly justify the last clause of the following, his own, inference,—“It seems almost conclusive that the use of alcohol not only has no power to defend those predisposed to phthisis from its attacks, but would, with little doubt, change the predisposition into active disease.” It seems to me that, in arguing the question, persons, placed in all other respects under favourable hygienic conditions, should be selected,—otherwise the point really examined comes to be, not whether alcoholism directly antagonises tuberculation alone, but whether it directly antagonises that tuberculation, and indirectly negatives the activity of all other anti-hygienic circumstances, the influence whereof in generating tubercle is matter of accepted experience.

Now, it would appear that publicans, who unquestionably as a class largely consume their own vendibles, are *ceteris paribus* less destroyed by phthisis than persons in various other walks of life.

Still, whatever be the interest in a scientific point of view of determining this question, it is perfectly clear the evidence of the preventive powers of alcohol should be overwhelmingly strong, to warrant the physician in deliberately prescribing an alcoholised regimen. Admitting even, *argumenti gratia*, that a life might occasionally be saved to the state by the steady consumption of spirits, how lightly would such gain counterbalance the weighty evil of giving fresh encouragement to the employment of intoxicating drinks,—of impressing the stamp of medical sanction, under

like these, while they defy explanation, justify us in declining to reject anything as important in the way of enlarging activity of blood modifying influences.

* New England Quarterly Journal, 1843

† New York Journal of Medicine, 1844

‡ American Journal of Medical Science, Oct. 1855

the cover of a plausible motive, on the use of that agent which has hitherto proved *the most powerful of all causes of crime, and the profoundest bane against which civilisation has had to struggle.*

(b) The relationships of leucocythæmia and tuberculisations have not, that I am aware of, been made the subject of investigation. *A priori* it would appear unlikely that a crasis of the blood, so markedly defined, as the leucohæmic, should co-exist with the conditions of that fluid appertaining to the tuberculous diathesis. The cases collected in Dr. Bennet's book,* give very unsatisfactory information on the point,—either because post-mortem examination was not made by their authors, or because the state of the lungs is scarcely referred to. As far as my own experience goes, it would depose to the rarity of co-existence of the two affections: but I have seen a slight excess of white cells, with enlargement of the spleen, in active chronic phthisis; † and *vice versa*, have known the life of a leucohæmic patient brought to a close by acute pulmonary tuberculisations [1349, c]. In this latter observation, however, I may have erred, having been unaware at the time the case referred to occurred, that white-cell nodules, simulating tubercle, may form in the lungs of leucohæmic sufferers.

(c) In former days anæmia was looked on as provocative of tuberculisations; then for a long while opinion seemed undecided as to its influence; while recently Trousseau taught, on the alleged ground of experience, that the state of blood in anæmia is positively antagonistic to the tuberculisating process.

Trousseau's notion cannot be treated as a matter of mere speculative interest, and accepted or rejected as the whim may take us. For it carries with it a grave practical inference: if anæmia antagonise tubercle, the attempt to give iron to the red disks where there is the least diathetic tendency to consumption, must be an error. Trousseau carries his conviction to the point of prohibiting the use of iron in anæmia, even in cases where the sole evidence of tuberculous proclivity is to be found in *the family antecedents of the patient*: his prescription for such patients would stand, "Let the chlorosis go on."

If it be true, as always taught, that one of every three persons, dying from all diseases indiscriminately in the Paris hospitals, has tubercle in the lungs, the existence of an almost universal family taint becomes an unavoidable inference. Trousseau's employ-

* On Leucocythæmia. Edinb., 1852

† Perce, U. C. H., Females, vol. xvi p 19

ment of iron in chlorosis must then, indeed, have been on a limited scale; while, on the other hand, the amount of mischief, done by his unconverted brethren in curing the anæmia of tuberculously disposed girls, becomes something fearful to imagine.

Nevertheless, my own conscience remains clear; though I have given iron in chlorosis, whatever the diathesis, since I first wrote a prescription, I have yet to meet with a single instance in which the cure of anæmia ushered in the outbreak of tuberculation. A pure assertion, it may be said: true,—exactly the same as the affirmation of Trousseau.

(*d*) Hysteria is, on the whole, repulsive of phthisis as a co-existence,—that is, if a woman with hysteria become genuinely phthisical, the nervous affection falls into abeyance. On the occasional simulation of phthisis by hysterical cough, chest pain, emaciation and even night-perspiration, it seems unnecessary to dwell: the physical signs will commonly, at least after the lapse of a short while, settle the diagnosis [1310, *dd*].

1284. (C) (*a*) The insane frequently die phthisical. Of 4141 specified causes of decease in lunatics, 525 were referred to phthisis, no other single disease furnishing so large a quota of deaths.*

(*b*) I reserve for future fuller consideration the question of the alleged antagonism between tuberculation and cyanæmia (or, incorrectly so-called, venosity of the blood),—as well as all affections of the heart entailing venous stasis and feeble oxygenation. There is abundant evidence to show that the alleged incompatibility has been seriously exaggerated.† On the other hand, that active cardiac disease and active tuberculation rarely co-exist is indubitable.

DURATION.

1285. The mean duration of phthisis has been calculated by estimable observers from the results of fatal hospital practice in Paris,—and, approximatively, fixed at 23·5 months.‡ But, in point of fact, concerning the average duration of a complaint which destroys life at periods so various,—which kills in twenty days, or leaves its eventual victim yet living at the end of five-and-twenty years and upwards—inferences of practical applicability can scarcely be established [1303].

* Robinson, in Ranking's Retrospect, vol. xvii. p. 24.

† Clin. Lecture on Tricuspid Regurgitation, "Med. Times," Feb. 14, 1857.

‡ In this estimate the rare cases in which the disease terminates by permanent suspension or practical cure are of necessity excluded.

Of 307 hospital cases observed by Louis, the following arrangement may be made :—

4 died within 1 month.			98 died within 6 months.		
15	..	2 months.	160	..	9
26	..	3 ..	264	..	24

Hence, at the end of two years, 43 of 307 patients only survive; so that at the time of seizure in any given case the chances are about as 6 : 1 that death will ensue before the commencement of the third year : the chances stand only as 2 : 1 in favour of passing the sixth month ; while those of surviving the ninth are against the sufferers in the ratio of 160 : 147, or closely as 1.09 : 1. These estimates refer to the period of first declaration of symptoms.

But there is every surety that a certain period passes before the advent of appreciable symptoms ; this period ought to be allowed for. Besides, the returns of Louis refer to a bygone condition of therapeutics, and they refer to France and to the population of hospitals.

I entertain no sort of doubt that the ordinary span of tuberculous existence ranges considerably higher than might be inferred from these figures. I frequently see patients, the onset of whose symptoms dated back five to ten years ; and it has occurred to me to know the period extend even to twenty-two years.

The disease runs a sensibly slower course in the better classes than among the poor, and among those of a non-tuberculous stock than among those hereditarily tainted. Tuberculised children often die of the disease at an earlier age than their phthisical parent, or parents, had done before them. Gintrac was probably right in regarding this as a proof of intensification of the disease by transmission [1299 (c.)].

1286. Season does not exercise the kind of influence which might be anticipated in shortening the career of the consumptive sufferer. It may be calculated from the Registrar General's Twelfth Report that the phthisical mortality in London during the five years 1845-1849, averaged in the quarter ending March, 1774, in that ending June, 1762, in that ending September, 1593, in that ending December, 1573. So that the mean deaths in the six coldest months rate at 3347, in the six warmest 3355. Compare these results with those concerning pneumonia [1137] ! From the contrast flows indirect evidence, supporting the doctrine, already glanced at, of the non-destructiveness of pneumonia in pulmonary phthisis [1280].

MODE OF DEATH.

1287. The modes of death in phthisis, singularly various, may be grouped under the following heads:—(A) Death of normal mechanism, through gradually increasing asthenia; (B) Death of gradually asthenic type in the main, but abruptly hastened by secondary lesions or intercurrent complications; (C) Sudden and unexpected death.

1288. (A) The gradual asthenic death of phthisis is brought about by exhausting discharges, waste of nutrient fluids, imperfect hæmatosis, insomnia, constant wearing suffering of various kinds, and, often in spite of free consumption of food, failing tissue-reparation.

1289. (B) In this category, appear instances of gradual extinction brought to a more or less rapid close by: ulceration of the bowels and profuse diarrhœa; obstruction of the intestine by cicatrization of ulcers; chronic peritonitis; pleurisy with effusion; pneumonia; perforation of the pleura; pain, irritation and dysphagia from epiglottic and laryngeal disease; perforation of the trachea and subcutaneous emphysema; hæmoptysis indirectly through sequential anæmia; Bright's disease; tuberculous meningitis; and simple* or tuberculous† pericarditis.

1290. (C) When death takes place suddenly and unexpectedly, the occurrence may, as Louis has well distinguished, prove explicable,—or inexplicable either before life is extinct, or even by the aid of post-mortem examination. In the category of explicable cases, appear sudden deaths by hæmoptysis, either from the amount of blood actually lost, or from asphyxiating obstruction of the air-tubes; by perforation of the pleura; by extensive sudden pneumonia of adynamic character; or by œdema of the glottis. In the second category, the fatal issue has been hypothetically referred to "fatigue of the heart," or to general reduction of the consistence of the brain. But the truth is, the clue to these mysterious deaths has not yet been found; I have examined more than one case, where each of the hypotheses proved equally untenable.

CAUSES.

1291. In a work, designed to be especially clinical, an inquiry into the general ætiology of tuberculisation would be out of place. There are, however, some causes, either real or alleged, of the

* Ryan, U. C. H., Females, vol. xiii p. 43.

† Meyer, U. C. H., Females, vol. xiii p. 7.

disease, so closely connected with its management, that the practitioner should have, as far as possible, a clear notion concerning them. Much interesting information on the general subject is to be found in Ancell's valuable work on "Tuberculosis."

1292. *Intimate cause (a).*—There is little reason to believe that primary digestion is necessarily at fault in the tuberculising process; but there are strong arguments for admitting that derangements of the secondary and tertiary changes of the food (sanguification and histogenesis) lie at the root of the evil. But how, and in what fashion? That in some way an enfeebled power of utilizing ordinary fat forms an element in the wrong state of things seems an inference that cannot be escaped; but that tuberculation is primarily and in essence due to such failure of power, whether or not arising out of defect in the action of the pancreas on the solid fat of the food, can only be regarded as an ingeniously put hypothesis.* And, conceding that the essence of the disease consists in a failure of fat-digestion, we only put the difficulty a step back; the question then arises, why are the digestive apparatuses of certain people inapt for this commonly easy part of the tissue-making process?

1293 (*b*). Whatever be the intimate nature of tuberculation, a definite product, the miliary granulation, is evolved by it. Has this product the properties of a virus? Can it be transmitted by inoculation, contact, or infection from organism to organism?

1294. (1) *Inoculation.*—Although earlier experimentalists failed, recent observers, led by Villemin, Lebert of Breslau, Wilson Fox, Burdon Sanderson, and Cohnheim, seem to have succeeded in establishing *artificial tuberculation* as a fact. If infective material, taken from a diseased gland, be injected under the skin, or into a serous sac, "the formation of nodules of new growth follows † in almost all organs except the brain:" these nodules "possess the structure of certain organs of the lymphatic system." ‡ The infective material is conceived to be solid, in a state of infinitely fine division,—as was long since shown by the late Prof. Graham to hold true of the material of contagion of acknowledged virus-diseases. Taken up by the veins and lymphatics, it is distributed by the arteries throughout the frame.

Dr. B. Sanderson's fundamental formula stands thus: "Whenever chronic induration, due to over-crowded corpusculatation, exists

* Dobell, Op. cit. p. 8.

† Or more correctly "may follow" the experiments do not always succeed, predisposition being apparently required.

‡ Burdon Sanderson, Ed. Med. Journal, Nov. 1869.

in an organ, it is apt to give rise to similar processes elsewhere." And as, further, it is allowed, that in properly predisposed animals, traumatic injuries (the introduction of a seton for example) will cause visceral tuberculosis, it would follow that medical men, in using issues and setons in scrofulously inclined persons, unwittingly take active measures for artificially tuberculisising them all ! Possibly, this is an inference from which some, now unforeseen, method of escape will be supplied by further enquiry.

1295. (2) *By contact*.—Contact could have no influence, except in promoting whatever might be proved to be the activity of infection.

1296. (3) *By infection*.—Is there any clinical evidence that the direct aspiration of particles of the *materies morbi* into the lungs can transmit the disease ?

Galen believed it dangerous to pass an entire day in the company of a phthisical person ; the timidity of Morgagni in regard of even the phthisical corpse has been recorded by himself. At the present day, in the south of Europe, the bed-clothes of a defunct patient are destroyed, and in the north, too, a belief in infection exists ; while in France and in this country philosophic incredulity almost universally prevails.

I find the deaths by phthisis of several physicians in France, known to have practised much among the consumptive (Bayle, Laennec, Dance, Delaberge), suggestively ascribed to infection.* Curiously enough, of the first three Clinical Assistants I had at Brompton, two died of phthisis, and the third left the establishment with slight hæmoptysis, cough, and chest-uneasiness. The latter is now in perfect physical condition ; one of the former had clearly been affected, before he came to the hospital ; the other was a model of sturdy health, when he took office. No similar case, as far as I am aware, has occurred during the many years that have elapsed since the opening of the institution : and the numbers of medical men constantly dealing with phthisis, and who escape the disease, must not be forgotten.

But the strongest argument, infectionists adduce, is founded on the frequent death by phthisis of the husband of a wife herself cut off by the disease or *vice versa*. That such deaths do pretty frequently occur is indubitable : but in some instances, careful inquiry shows the putative victim of infection was already tuberculous at the time of marriage ; or that he sprang of a more or less thoroughly phthisical stock ; while the converse cases, long since insisted on

* Parry, Phthisis, p. 31.

by Portal, where a husband has had two, or even three wives successively destroyed by phthisis, himself wholly escaping, are too frequently lost sight of.

Again, the circumstances which bring on the disease in one predisposed person, are likely enough to bring it on in another; and, it must be remembered, husband and wife are often in a great measure exposed to anti-hygienic influences of the same classes and of the same activity.

There is, besides, the statistical argument, which has never, that I am aware of, been seriously examined.* What are the chances, that a given individual, either actually phthisical, or manifestly fated to become so, will unite with a consort similarly conditioned? The answer will vary with locality, walk of life, and, above all, the age of the contracting persons; but the chances would, I feel positive, be considerable, if the union took place within the period of existence, at which tubercle is most common. Probably one in seven or eight of young married men has a wife, who will one day die of phthisis, according to an estimate made by Dr. John Beildoe. Grant, then, that the male is tuberculous, and I apprehend, we have a calculable frequency of this form of double phthisical death quite as high, as any that has been actually observed. If this be actually so, the influence of infection remains anything but proven.

1297. Nevertheless, while allowing their full weight to these objections, I must confess my belief in the reality of such transmissibility has of late years strengthened. I have now met with so many examples of the kind, that "coincidence" becomes itself an explanation difficult of acceptance. I have besides in three instances seen a robust husband become distinctly and actively phthisical, as shown by general and local symptoms and physical signs, and on the death of his phthisical wife, whom he had closely tended, fall into the retrogressive-stage of the disease and ultimately practically recover.

I believe, too, the ill influences of the person diseased are more effectually transmissible, after copious purulent expectoration has set in,—and have been led to recommend free inhalation of carbolic acid to the non-consumptive consort, as a prophylactic measure, when segregation would not be submitted to. The infective material is, of course, much more likely to be expelled with the

* See, however, Young, *Consumptive Disease*, p. 167.

air of expiration, after softening has taken place on a free scale, than prior to that change.

Obviously, the success of artificial tuberculisation in bovine animals and in the quadrumana lends direct support to the notion of transmissibility by infection in the human subject. Tuberculisating experiments repeatedly fail; a wife or husband commonly escapes being infected by a diseased consort: in both cases the absence of predisposition appears a valid explanation.

1298. *Hereditary transmission.*—Diseases in which there is a *matrices morbi*, more readily transmissible than others from parent to child, tend to affect families, stock, and finally race.

1299. Some years since I made an attempt to determine the frequency of hereditary transmission of phthisis, by comparing two series of persons, the one phthisical (162 in number), the other non-phthisical (284 in number), and was enabled to draw a certain number of conclusions, some of which may be here set down.*

(a) The first general result was, that about 26 per 100 of my tuberculous patients came of a father or mother, or of both parents, similarly diseased. But does this result prove, even in this limited proportion, the reality of *hereditary influence* in the production of the disease? "I think not. It shows that of a given generation (b) about 26 per 100 come under certain ascertainable conditions of a tuberculous parent (generation a). But this ratio of 26 per 100 might be, and probably is, no higher than that of the tuberculised portion of the population generally. In other words, it might be predicated of any class of individuals taken in hospitals (and of whose history nothing is known, the non-phthisical and the phthisical mixed therefore) that about 26 per 100 of the generation from which they sprang were tuberculous. Hence there would appear to be nothing, in the mere fact of 26 per 100 of my patients having had a tuberculous parent, to prove that their disease arose under hereditary influence. Hereditary transmission would be rigidly demonstrated were the 26 per 100 furnished, generation after generation, by lineal descendants of an original tuberculised stock. But I need scarcely observe that the existence of such lineal transmission has not only not been demonstrated, but not even suspected, to prevail."

(b) "The question may be examined under another aspect. The ages of the tuberculous portions of any two succeeding generations (a) and (b) are (it is legitimately to be assumed) the same. Now we learn, first, from a previous table, that 23 only of 629

* British and For. Med. Chir. Rev., p. 235, January, 1849.

phthisical persons in a given generation (*a*) marry under 25 years of age; secondly, in the next generation (*b*) we find, according to the same table, that of 629 phthisical individuals, there will be 263 under that age; now, thirdly, 240 of these 263 do not marry,* and hence do not propagate phthisis: yet in the next, or third, generation (*c*), the total proportional number of phthisical persons to the population will be just the same as before,—and consequently there has sprung up in this generation (*c*) an equal amount of phthisis from a less amount of phthisical parentage. Hence either phthisical stock has a great tendency to multiply, or much phthisis is, in each generation, non-hereditary. Now the latter alternative is the correct one: no proof has ever been given that such stock is specially prolific."†

(*c*) The final conclusion flowing from this analysis of the family history of 446 persons is "*that phthisis in the adult hospital population of this country is, to a slight amount only, a disease demonstrably derived from parents. It is possible (nay, indeed, probable, for, in adults having a parental taint, the outbreak of the disease occurs a mean period of two years and nine months earlier than in those free from such taint) that, were investigation extended to infancy, childhood, and youth, the ratio of cases of parental taint among the phthisical would be proportionally greater than it proves, where inquiry is limited to adults. But on the other hand, there is no single valid reason for supposing, prior to actual experience, that the increase in that ratio would be of more than trifling amount. Again, whether the law differs in the adult portion of the middle and upper classes of society from that holding in the humbler classes (those supplying hospitals) can only be positively determined by an analysis of family histories collected among the former classes; meanwhile it appears justifiable to doubt the reality of any such difference.*"‡

(*d*) It further appeared that females were about 14 per 100 more frequently of tuberculous origin than males; and that a tainted parent is more likely to have children of the same, than of the opposite, sex similarly affected.

1300. *Influence of Stays.*—Although it is essential that females, already tuberculised, allow as free play as possible to the lungs, I do not by any means accede to the doctrine, that the use of stays

* A small correction should be made for illegitimate children.

† I have since examined this question numerically, as mentioned in a previous paragraph [1236], and the result shows that some slight allowance must be made for extra fertility of the phthisical female.

‡ Report, loc. cit. in Brit. and For. Med. Rev., p. 254, Jan. 1849.

will produce pulmonary consumption. Whether this article of dress shall or shall not inflict mischief on the lungs will probably, as I have elsewhere said,

"altogether depend on the amount of constriction. If this be simply sufficient to transfer the maximum chest play from the base to the apex of the thorax (or, rather, to transfer somewhat the breathing difference superiorly and inferiorly natural to the female), I cannot very easily describe what evil is to come to the lungs, especially if the stays be cut bias, or on the cross, and be formed of yielding material. If, on the other hand, rigid wood-work or metal plates be used to stiffen stays, of which the main material is hard and cut straight, then it is conceivable, *a priori*, that serious evil may come to the lungs. Remember, however, the wide difference in the statical and dynamic mechanism of the thorax and abdomen, and you will feel at once that the fact of serious compression of the liver being produced by tight lacing, gives no shadow of proof that the pulmonary organs must suffer to similar amount, or even in similar fashion. I know not, as matter of clinical experience, what the mode of disturbance is which constriction of the base of the chest actually and demonstrably entails on pulmonary action or pulmonary structure. Still, such ignorance as this is not commonly avowed; on the contrary, the mass of information on the point is held to be positive and of ominous, most ominous, quality. Dr Copland, for instance, writes, that the use of stiff stays produces 'ultimately a morbid state of the blood, tubercular deposition, especially in the lungs, hæmoptysis, anæmia, &c.' But, it may be fearlessly asserted, no single proof exists that the abuse of stays produces the specific disease tubercle. Dr Farr, it is true, speaks thus:—'Thirty-one thousand and ninety English women died in one year of the incurable malady, consumption. Will not this impressive fact induce persons of rank and influence to act their country-women right in the article of dress, and lead them to abandon a practice which disfigures the body, strangles the chest, produces nervous or other disorders, and has an unquestionable tendency to implant an incurable hectic malady in the frame.'* But Dr Farr omits to compare the relative mortality of the sexes in elucidating this question. Look at this table giving the mortality from consumption in three years to a million living of each sex in England and Wales—

YEARS	Deaths from Phthisis to 1,000,000 Living of each Sex.	
	Males	Females
1837	3,771	4,155
1838	3,783	4,077
1839	3,722	4,015

What evidence does this table give of the dependence of tubercularisation on stays? It simply shows that the phthisical mortality of females is somewhere about 300 per 1,000,000 living greater than that of males. Granting that the female excess is really due to stays, does its amount justify Dr Farr's strong phrases? I think not. But let me assure you, no particle of evidence exists that the moderate excess of female destruction is really traceable to the abuse of stays. Not a few arguments might be adduced, tending to prove their absolute innocence. Thus in France, as is well known, females rarely use stays until the afternoon; in England, women tighten themselves up the moment they rise in the morning; yet the excess of female phthisical mortality over the male is greater in France than in this country. Again, in certain parts of Europe the men tighten themselves at the base of the chest, so as to produce a tolerably fair image of the figure of a wasp, and yet they do not seem thereby to increase their relative quota of phthisical mortality. Further, it will be conceded that tight lacing is, as a rule, pushed to greater lengths among metro-

* Letter to the Registrar-General, 1840, p. 73.

politan than among rural female populations; so that, if the influence of stays be other than a figure of the lion, the plus phthisical destruction of women over males ought to be relatively greater in London than in the country. Now such evidence as I can get at, tells in precisely the contrary direction. Also examine these figures —

KENT COUNTY

Year.	Males	Females
Population in 1841	232,228	234,483
Absolute deaths from Phthisis	726	774
Deaths from Phthisis per 1,000,000 living	3126	3242

METROPOLIS.

Year.	Males	Females
Population in 1838	913,977	971,767
Absolute deaths from Phthisis	4,057	3,371
Deaths from Phthisis for 1,000,000 living	4,443	3,735

So that, actually, where, by fair inference, the amount of stay-constriction is greatest and its prevalence widest (in the metropolis), females are destroyed by phthisis in a less degree than males; whereas, amid a country population, which we may honestly assume to undergo a less mean amount of tightening, females die consumptive in a notably larger proportion than males.

"No, gentlemen, if the abuse of stays produce consumption, its power to do so most indubitably remains to be proved, and while the laws of an enlightened pathology point to the excessive improbability of an essentially fatal disease springing from a mechanical cause, I entreat you not to adopt the popular creed, that 'stays cause consumption,' unless on direct and unimpeachable legal evidence. There is quite enough, in the demonstrable evils, entailed by tightening, to justify you in warring against the abuse, you have no need to support your arguments by an unfair appeal to an imaginary mischief."

1301. An opinion very widely spread holds that a "*below-par*" state of health favours the outbreak of the essential vice of nutrition that constitutes the tuberculising process. This doctrine has never been, and could in fact with difficulty be, made the subject of proof. Meanwhile it is discordant with the truth, that the evidences of tuberculisation often arise in the lungs co-evally with the earliest systemic changes in the so-called "*premonitory stage*," while, when these evidences are not to be found, the failure depends quite as probably on the imperfection of our means of investigation, as on their absence. Cases commencing by hæmorrhage originate in people whose health is of model excellence.†

* I like the opportunity of drawing attention to the admirable corset invented by Pehardy, the so-called Non-Constricting Corset, and sold by Roland & Co., 68, Park Street, Grosvenor Square.

† Lectures on Influence of previous Health on Disease, *Lancet* vol. i. 1871

1302. *Influence of Climate.*—Some few propositions of practical significance on this head may be deduced from facts worked out by various observers.

(a) No climatic condition seems to render phthisis an impossible disease. It may fairly be called quasi-ubiquitous.

(b) The most strongly antagonistic influence, yet substantiated, appears to be exercised by the climatic conditions of extreme altitudes. Dr. A. Smith draws attention to the fact that in localities in the Andes, 7,000 feet and upwards above the sea-level, where the air is dry, the temperature about 60° in the shade, and the sky sunny throughout the greater part of the year, tuberculous disease of the lungs is only known as an exotic.* Fuchs has collected an extensive series of data, designed to show that in Northern Europe consumption is most prevalent on the level of the sea, and decreases with increase of elevation to a certain point.† And a strong body of evidence has been adduced in his remarkable work by Mulry,‡ tending to establish the conclusion that phthisis diminishes very much in the ratio of the elevation, until it finally disappears. Kuchenmeister goes yet further (possibly too far), and, assuming the fact of immunity, seeks to establish the precise elevation at which it is achieved in various latitudes.§

Although exceptional cases occur (for instance, on the heights of Abyssinia and at Madrid, which at an altitude of 2,000 feet above the sea-level, furnishes much more phthisis than towns situated on the plain below), it seems impossible to question the fact that an antagonistic influence in regard of pulmonary tuberculation is exercised by the combined conditions of lofty sites. The massy normal development of the lungs in the inhabitants of such altitudes [1036] seems to afford a clue to the rationale of the antagonism; more especially as *tuberculous deposition is by no means very uncommon in certain other organs of natives of the highest habitable regions.*

(c) Phthisis exists in every zone of the earth's surface.

(d) Regions, districts, and places remarkable for the smallness of their phthisical population lie without the temperate zone.

(e) In certain spots of the torrid zone phthisis is peculiarly prevalent,—as thoroughly endemic as in the British Isles. The Littoral of Peru, the Marquesas Islands, may be instanced. Yet on

* Br. and For. Med. Chr. Rev., Oct. 1856, p. 430.

† Quoted by K. Johnson, Physical Atlas.

‡ Br. and For. Med. Chr. Rev., Jan. 1859; or *Klimatologische Untersuchungen*, 1858.

§ Oesterreich. Zeitschrift für Heilkunde, 1858.

the other hand close to the Equator, as in the Madras Presidency, phthisis is rare. This difference is independent of difference in elevation above the sea-level.

(f) According to Boudin * the prevalence of phthisis decreases in proportion as we travel northwards,—in America, from the 44th degree of latitude, and in Europe from the 58th degree. This law is exemplified in Europe by the almost complete absence of consumption in the North of Norway, the Shetlands and Hebrides, the Faroe Islands and in Iceland. But Guilbert † undoubtedly goes beyond the facts in affirming that, as far as temperature is concerned, the disease regularly diminishes in prevalence from the Equator to the Pole. And it is plain there has been great exaggeration, if not complete error, in regard of the alleged immunity of various places. In the Shetland Islands, for instance, the disease is in reality far from uncommon; ‡ and that the natives of the Hebrides wholly escape the disease seems more than doubtful. §

(g) Absolute climatic cold, or absolute climatic heat, and combined in each case with excessive moisture, is less conducive to the development of phthisis than variability in these qualities.

(h) Yet in Iceland, where such variability holds to a maximum degree, the disease appears to be singularly rare. And this is but a single illustration of the general truth that there exist, in each of the earth's zones, spots enjoying a more or less complete immunity from phthisis, the exemption of which is inexplicable on any acknowledged meteorological principle. If, *exempli gratia*, we fancy we have satisfactorily explained the rarity of phthisis in Middle and Upper Egypt and Syria, by the heat and dryness of the air combined, we are met by the difficulty that certain low-level spots in the East Indies enjoy a somewhat similar exemption in spite of the marked humidity of their heated atmosphere. And, again, Nubia, Chili, and South Africa are as dry and warm as Upper Egypt, yet in all these phthisis is more or less notably prevalent.

(i) Islands and littoral districts are ostensibly favourable in the main to the free development of phthisis; yet observe, that the natives of the Azores, Madeira, Iceland, the Faroe Islands, Naarstrand on the coast of Sweden, spots climatically various as their sites, suffer very slightly from the disease.

* Géographie Médicale

† Traitément de la Phthisie.

‡ H. I. Saxby, M.D., in Dobell's Reports, vol. ii. p. 527, 1871.

§ Dobell's Reports, vol. ii. p. 388, 1871

(j) Malarial poisoning of the air can scarcely be separated from the elements of the climate of any place where it exists. Its antagonising influence is elsewhere considered [1282, c].

(k) Whatever be the influence of abundant ozone in generating catarrhal affections of the air-passages, evidence is wanting as to its power to promote or to impede the growth of phthisis.

And hence we are constrained to admit, that although the evidence is too strong to justify us in denying as an empirical fact, both the affirmative and the negative influence of "climate" *quoad* the generation of the disease, the factors through which it works are unknown. Take any combination, you will, of temperature, moisture, insolation, electricity, physico-geological conditions of soil, and barometric pressure, and you will find phthisis more or less rife on any spot of either hemisphere presenting that chosen combination. The real potential conditions of climate, both antagonistic and attractive, with the exception to a certain extent of barometric pressure, consequently remain unrevealed.

In some of these places the comparative immunity from phthisis has been referred to the habits of the population. The use of peat for fuel has been credited with this protective influence since the days of Willis, two centuries ago.*

PROGNOSIS.

1303. (a) The wideness of the gap between the extremes at which death occurs—three weeks and upwards of five-and-twenty years—makes the calculation of a mean for prognostic purposes a useless piece of pedantry [1285].

(b) The proportion of recoveries is unfortunately too small to justify us in going further in any individual case than the admission, that release from the incubus of phthisis is not an absolute impossibility.

(c) There is no given combination of signs and symptoms so promising, that death may not rapidly occur; there is no array of sufferings, local and systemic, so grave, that death may not be sensibly delayed.

(d) The stage of the disease *per se* is a most faithless guide; the attempt to read the future is oftener easier and more warrantable, after lung-breakage has been achieved, than during the so-called "premonitory stage."

(e) Natural disposition to slow progress justifies a more favourable view as to prolongation of life, than earliness of the time at

* Quoted by G. F. Elliott, M.D., Brit. Med. Journal, June, 1880.

which treatment, even under the most favourable antecedents and attendants, is commenced.

(*f*) The disease is commonly held to run a more rapid course in the young, than in those of advanced adult years. But my results at Brompton tended to show that in all probability (though individual exceptions may occur) age exercises less influence on the result of the disease, and on its amenableness to treatment, than is usually supposed. I may mention, the mean age in 8 cases of suspension of the disease was 21.12 years; in 45 cases of death 29.96 years.*

(*g*) Complete removal of symptoms more frequently occurred in my male than female patients, in the ratio of 10:100: 34.9. But, on the other hand, the general results proved slightly more favourable in females than in males.†

(*h*) Phthisis, if hereditary, commonly runs a more rapid course than that of strictly acquired origin: to this rule I have, however, seen some well-defined exceptions.

(*i*) I found at Brompton that the chances were "very evidently more favourable for those who had wholly pursued their trades out of, than those who had laboured within, doors."‡

(*k*) Activity of local progress, whether this be shown by rapid passage within a limited area to the third stage, or by quick encroachment of the tuberculous process on a large mass of lung, is, as a general rule, of evil augury.

(*l*) The presence of antagonising diseases, while it interferes with the process of genuine tuberculous extinction of the individual, will hasten or retard actual death according to the proper nature of those diseases.

(*m*) Particular secondary lesions, or even symptoms, may aid us in estimating the chances of life. Chronic peritonitis is almost invariably fatal, and pretty quickly so [1267]; the tortures of laryngeal and epiglottic disease habitually reduce phthisical existence notably below the average. Perforation of the pleura is commonly, though by no means of necessity [911], rapidly mortal.

(*n*) The prognosis of tuberculous hæmoptysis has its special importance. Hæmoptysis may kill *directly or indirectly*; but my analysed series of 131 hospital cases of phthisis furnishes but two examples of such modes of death. In one, death was direct, but from asphyxia, not loss of blood: the trachea and bronchi, as far as traceable, were plugged with coagula. In the other, death

* Report in Brit. and For. Med. Chir. Rev., Jan. 1849, p. 233.

† Idem, p. 232.

‡ Idem, p. 232.

occurred from exhaustion five days after the hæmorrhage. In these, and some other fatal cases that have fallen within my observation in private practice, the patients have invariably been *males*; in this point of view, as well as in certain others [1241], hæmoptysis is a more serious event in men than in women.

A first hæmorrhage having been severe, it is unlikely that a subsequent one will kill *directly*; for it is not often that a recurring hæmoptysis is more violent than a first severe one, granting that they do not follow so closely upon each other as to appear a mere continuation of one and the same attack. One of the cases above referred to, however, constituted an exception to this rule.

It appears from the cases I have examined, that hæmoptysis is frequent in proportion to the duration of the primary disease; if so, the converse of the proposition cannot be evaded; and we are forced to conclude that *frequently-recurring hæmoptysis does not reduce the mean duration of life, after seizure with tuberculous symptoms, in any given mass of cases*. It is not repugnant to reason to admit, then, that in a certain number of instances hæmorrhage from the lungs may act as a local therapeutical agent. No doubt the disease sometimes runs on more rapidly after an attack of hæmoptysis; but are the two conditions more than coincidences? In these cases phthisis is supposed to be both subjectively and objectively established; the different class in which hæmoptysis seems to prelude the disease is elsewhere considered [1241].

(o) The ash-grey purulent condition of sputa [1240] betokens a not far distant close of the struggle, if it occur in a patient under treatment; when found in sufferers, who have greatly neglected themselves up to the time of seeking advice, it is generally rapidly modified by medical care.

(p) Careful watching of the frequency and phthisical character of the pulse [1244], of the pyrexia, and amount of general constitutional suffering, will in the mass of cases deceive less often than too slavish attention to the sole physical signs.

(q) But whatever be the amount of help gained through these various elements of prognosis, the young practitioner must remember, there is a certain condition of general asthenia, in which, though the local suffering be slight, and the digestive functions active and fairly reparative, life cannot be insured an hour; nor *per contra* is there any combination of circumstances, clearly appertaining to the disease itself, from which at least temporary recovery may not be established.

(*r*) From all this, it clearly flows, our prognostic faculty in phthisis is painfully limited: ready willingness to foretell issues simply proclaims inexperience.

(11.)—RETROGRESSIVE CHRONIC TUBERCULISATION.

1304. The removal of tubercle from the lungs is conceivable in three different ways: (*a*), by simple absorption: (*b*), by absorption combined with so-called "saline transformation;" and (*c*), by elimination.

(*a*) With respect to the possibility of simple absorption, the evidence is hardly convincing; the arguments in favour of the occurrence, too long for reproduction here, may be found in the art. *Adventitious Products*.*

(*b*) Of the molecular removal by absorption of the animal ingredients of tubercle, while saline matters remain and are in addition deposited in their room, no doubt can be entertained: the gradual change of the tuberculous material may be traced from a condition of mere desiccation, with greasiness to the feel, to that of osteopetrous substance. The production of this change is generally associated with neighbouring infiltration by simple exudation, which hardens into induration-matter or fibroid structure, and by its contractile force, aids the absorptive process. The saline materials and the induration-matter may eventually be themselves absorbed,—puckering of the parenchyma, at a spot where obliterated bronchial tubes and blood-vessels converge, alone remaining as the indelible evidence of the past mischief. These conditions have not unoften been erroneously ascribed to the cicatrization of cavities.

(*c*) Removal of tubercle by elimination, with loss of texture, having been effected in the progressive disease in the manner described [1231], what comes of the resultant excavations? First, they may increase in size by communication with fresh cavities formed by tubercle softening around. Secondly, they may become lined with a pseudo-mucous membrane and cease *per se* to give serious annoyance. Thirdly, if on a small scale, excavations may probably cohere by their opposed walls. Of the cicatrization of a large excavation, I have in vain looked for an example; and without meaning to assert the sheer impossibility of the event, I must maintain it to rank with the *mirabilia* of morbid anatomy. The evidence on the question may be found in the same article.

* *Cyclop. of Anat. and Physiol.*, vol. iii. p. 104.

1305. In brief, the essential anatomical conditions accompanying the suspension or retrogression of phthisis may be set down as follows:—

Tuberculisation Arrested in

First Stage—Amount of deposit originally small; ceases to take place; tubercle remains as such; collapse of cells and lobules; obstructed bronchial tubes on minute scale; local atrophy of parenchyma; local emphysema.

Second Stage—Reduced bulk of affected part by contraction of induration-matter, hardening, puckering of surface and substance, collapse and atrophy of parenchyma, emphysema.

Third Stage.—Cavities of various size continue to secrete pus or muco-pus; bronchial tubes closed beyond them; collapse of communicating tissue; the cavities are lined with a pseudo-mucous membrane.

Tuberculisation Retrogressive in

First Stage—Absorption of tubercle, previously calcified, or sometimes, in all probability, independently of any such change; much bronchial obstruction; local collapse and atrophy, local emphysema.

Second Stage—Induration, contraction, collapse, atrophy of parenchyma, union of broken surfaces by exudation matter, producing linear or irregularly pitted cicatrices, provided the breakages of lung-substance have been on a very small scale.

Third Stage—Great reduction of bulk of excavated portion of lung, substance of which, where not excavated, is more or less replaced by induration matter; more or less deep indentations of pulmonary surface by contracting fibro-plastic matter in pleura; more or less marked reduction of area of cavities, but doubtful if actual closure occurs, where the original excavation has been on a large scale.

1306. Local and limited suspension or retrogression of tuberculous disease is, at one or other stage, and for a shorter or longer period, one of the most common occurrences in its evolution. I hold, indeed, that anatomical evidences of such retrograde action may invariably be found in the lungs of persons cut off by chronic phthisis. But this is a very different thing from admitting that, clinically, pulmonary consumption thus frequently stops in its onward course. For, the truth is, that on the one hand, while action of curative import takes place in one part of a lung, fresh deposition of tubercle, or fresh disintegration of tissue, may be advancing in another; and, on the other hand, the duration of the stationary or retrogressive state is often so short, that, clinically speaking, the tuberculised patient is scarcely a gainer.

Nevertheless, in a certain undetermined, but unfortunately very small, proportion of cases, a constitutional change arises in conjunction with local reparation, antagonistic to, or actually preventive of, the fresh deposition of tubercle; in these instances genuine practical cure of the disease is accomplished.

1307. *Physical signs of phthisis tending towards cure*.—The physical signs of arrested and retrogressive tuberculisation vary so widely, not only with the stage and conditions of the disease

actually present at the moment suspension of its progress was effected, but also with the length of time that has intervened between such suspension and examination of the chest, that it is impossible to establish precise general rules on the subject. I shall consequently simply put down a few specimens of the conditions that have fallen under my notice in particular cases.

(a) Notable depression, supra- and infra-clavicular and supra-scapular, imperfect expansion, very weak, harsh respiration, percussion of Type I. [195], exaggerated fremitus, and strong vocal resonance. Here softening signs on a small scale had existed eighteen months before.

(b) Similar depression, imperfect movement and toneless percussion-sound, dry clicks audible with deep inspiration, which is weak and harsh. Here softening signs had existed only six months before.

(c) Want of tone on percussion at the apex, feeble bronchial breathing with a deep-seated creaking sound in inspiration [345]. Here, nine months before, softening signs were actively present, and both the local and general symptoms seemed to promise a rapidly fatal issue. I have not seen this patient professionally since the above observation was made, and cannot say what the local state may now be (seven months later); but I know by report that her general health is excellent, and that there are no chest symptoms, except occasionally slight cough.

(d) In these three instances suspension, and more or less perfect retrogression in the second stage, seem to have been accomplished. Here is another example. A girl aged fifteen, one of whose sisters had died of rapid consumption under my care at Brompton, presented in July, 1850, serofulous keratitis, enormous cervical glands, the signs of enlarged bronchial glands, with toneless percussion at the left apex, front and back, bronchial respiration, excess of vocal resonance, and large-sized thin liquid rhonchus, purulent expectoration and notable loss of flesh.* In 1853 this patient was kindly sent to me by Dr. Routh, who had accidentally seen her, with all the attributes of health, her glands in a perfectly natural state, and with the exception of slightly weak respiration at the left apex, not a single morbid physical sign. In October, 1854, she had grown " hugely fat." In March, 1855, marked dulness existed at the left supra-spinous fossa, moderate at the left, very slight at the right infra-clavicular region; under the left clavicle the respiration reached the ear very

* A. Petrusini, U. C. H., Females, vol. v. p. 175.

feeble, high-pitched, and mingled with dry and moist small-sized crackling. I saw her last in April, 1861, and in excellent health.

(e) Deficient mass of percussion-tone below the clavicle, with slightly tubular quality, hollow dry cavernous respiration, vocal resonance diffusely exaggerated: I have recently seen a case with these signs, where, from the account given me, I infer that four months previously the progress of phthisis had been most active. At a more distant period, the signs may continue much the same. Thus I saw in May, 1853, a girl (E. Blow) whom I had first known with excavated lung, six years before, and whose history pointed to seizure yet four years earlier, in whom the signs of excavation still existed in the form of hollow respiration with tubular percussion-note; but there was no rhonchus, and the chest had lost somewhat of the flattened phthisical look habitual to it for years.

(f) Contraction of a large excavation on the left side may draw the heart upwards to an extraordinary amount. I have recently seen a case of the kind in which cardiac pulsation was markedly perceptible in the *first interspace*, and positively, though feebly, felt against the *first rib*. With the advance of the contracting process the expiration-sound may gradually rise sensibly in pitch [300].

(g) Respiration laboured, and of jerking rhythm, weak and bronchial, but without clicks or rhonchal sound of any kind, and with very slightly deficient resonance under percussion. Here there had been, two months earlier, much greater dulness under percussion, respiration of diffused blowing type and cogged-wheel rhythm [278], along with general symptoms of advancing tuberculation. Exudation had probably disappeared, and the tuberculous deposit become quiescent.

(h) Lastly, I have known some instances where the physical signs of induration had existed at either apex to a slight amount, in individuals belonging to a tainted family, where the local and general symptoms of phthisis had made their appearance, and where the signs in question totally disappeared along with the symptoms, leaving behind them merely trivial harshness in the respiratory sounds. These I believe to have been examples, not only of tuberculation, but of phthisis, retrograding in the first stage.

DIAGNOSIS.

1308. The so-called "premonitory" stage may be divined as a possible existence by means of the weighing-machine and the

thermometer. If the absence of other causes of failing weight and rising heat can be made positive, the diagnosis acquires some certitude: but he would be a bold man, who, in a case where *the decision really was of practical importance*, dared to base an opinion on these conditions. On the other hand, a natural state of temperature would argue powerfully against the existence of tubercularisation; with greater force than the maintenance of an individual's natural standard of weight.

1309. But, even when anatomical changes must have occurred, the diagnosis of the disease, though exceedingly easy in many cases, is in some only to be successfully made by a patient use of all attainable aids,—the physical signs, the local and general symptoms, the microscopical characters of the sputa, the nature of existent surrounding changes, and finally certain subsidiary conditions.

The physical signs of the different stages have already been fully described. Now, there is nothing *per se* distinctive of phthisis in any of those signs; their localisation at the apices and gradual extension downwards alone give them pathological significance. In themselves they merely denote condensation, softening, and excavation,—and supply no evidence of the nature of these processes.

Clubbed finger-ends and incurvated nails (if empyema and cyanosis be absent) will add to the surety of a diagnosis essentially based on other grounds. The progress of mischief relatively in the two lungs, and in the two sexes [1233], scarcely follows sufficiently fixed laws to furnish real help. The existence of hereditary taint tends to confirm a diagnosis otherwise arrived at. The presence or absence of one or other of the diseases antagonistic to, or attractive of, phthisis may, with caution, be employed as an element of opinion.

The general value of results with the spirometer has already been considered [127]. Their practical significance *quoad* phthisis may be expressed as follows:—If a person, seen for the first time and examined with the spirometer, blow a number of cubic inches exceeding the alleged average of men of his height, the inference, that therefore his lungs are sound, is unjustifiable; they *may*, at the very moment, be excavated by tubercle. If, conversely, an individual fail to blow up to, or even nearly to, his computed physiological standard, his lungs may nevertheless be perfectly sound. And conceding, *argumenti gratia*, that the failure shows unsoundness of lungs, it throws no light on the nature of the pulmonary

disease. They who maintain that phthisis can thus be diagnosed, may, it is true, refer to examples of successful diagnosis on this principle, but, simply on the doctrine of chances, he must often prove correct, who, given a chronic pulmonary affection, pronounces it at once to be tuberculous,—such is the vast preponderance of that form of disease.

The direct evidence, deducible from hæmoptysis [1211], and from the microscopical characters of the sputa [1240], may be learned from statements already made.

The secondary morbid changes of deepest diagnostic significance are chronic peritonitis, persistent diarrhoea without obvious extrinsic cause, chronic laryngitis and epiglottitis, and a peculiar form of meningitis [1273]. In all these cases it is essential that cancer, syphilis, and Bright's disease be demonstrably absent.

The distinctive marks between phthisis and chronic bronchitis with dilated bronchi [680], pulmonary atelectasis [970], chronic pneumonia [1166], chronic pleurisy [784], cirrhosis [1417, *d*], and cancer [1390, *c*], will be severally found in the paragraphs here referred to.

1310. The subject may be further illustrated by conditions and combinations arising more or less frequently in actual practice.

(*a*) A young adult, who has had an obstinate cough, which commenced without coryza and without any very obvious cause, a cough at first dry and subsequently attended for a time with watery or mucilaginous-looking expectoration, and who has wandering pains about the chest, and loses flesh even slightly, is in all probability tuberculous.

(*b*) Should there have been hæmoptysis to the amount of a drachm, even, the diagnosis becomes, if the patient be a male and positively free from aortic aneurism, mitral disease or hypertrophy of the right ventricle, yet surer.

(*c*) If, besides, there be slightly morbid percussion [Types I. or III.] at one apex, with divided and harsh respiration, *while the resonance at the sternal notch is natural*, the diagnosis of the first stage of phthisis becomes next to absolutely certain.

(*d*) But not absolutely certain: for I have known every one of the conditions in *a*, *b*, and *c* exist (except hæmoptysis, the deficiency of which was purely accidental), where one apex was infiltrated with encephaloid cancer, and no cancer had been discovered elsewhere to suggest to the physician its presence in the lung.

(*e*) If there be cough, such as described, and permanent weak-

ness and hoarseness of the voice, the chances are very strong, provided he be non-syphilitic, that the patient is phthisical.

(*f*) If decidedly harsh respiration exist at the left apex, or at the right apex behind, if the rhythm of the act be such as I have called *cogged-wheel* [278], and there be percussion-dulness, so slight even as to require the dynamic test for its discovery, there can be little doubt of the existence of phthisis.

(*g*) If, with the same combination of circumstances, deep inspiration evoke a few clicks of dry crackling rhonchus, the diagnosis of phthisis, so far as I have observed, is well-nigh certain.

(*h*) If these clicks, on subsequent examination, grow more liquid, the transition from the first to the second stage may, as a rule, be very surely announced. But all the conditions of *f*, *g*, and *h*, may be simulated in infinitely rare cases of combined local simple consolidation and bronchitis: the adjoining induration gives bronchial rhonchi a clear ringing quality.

(*i*) If there be slight flattening under one clavicle, with deficiency of expansion-movement, harsh respiration and slight dulness under percussion, without the local or general symptoms of phthisis, the first stage of true tuberculisation cannot be diagnosed with any surety, unless there be incipient signs at the other apex also: the conditions in question limited to one side might depend on chronic pneumonia or on thick induration-matter in the pleura.

(*k*) The existence of limited, though marked, percussion-changes under one clavicle, with bronchial respiration and pectoriloquy, so powerful as to be painful to the ear, the other apex giving natural results, will not justify the diagnosis of phthisis. I have known this combination of signs, where the apex of the lung was of model health, while a fibrous mass, the size of a walnut, lay between the two laminae of the pleura. I would even go further, and say that the combination in question is rather hostile than otherwise to the admission of phthisis; as, had tuberculous excavation formed at one side, the other lung would, in infinite probability, have been affected with the disease in an earlier stage.

(*l*) Pneumonia, limited to the supra and infra-clavicular region on one side, and not extending backwards, is commonly, but not always, tuberculous.

(*m*) Fine bubbling rhonchus, limited to one base posteriorly, is not, as has been said, peculiar to tubercle; it may exist in emphysema and in mitral disease.

(*n*) Chronic peritonitis, in a person aged more than fifteen

years, assuming that abdominal cancer can be excluded, involves as a very great probability the existence of tubercles in the lungs. To this law of M. Louis, it is necessary to add the qualification, provided Bright's disease be also absent. But the question of cancer is far from easily settled: thus there may be pain and tenderness, evidently peritonitic, ascites varying in amount from time to time, now a relaxed, now a somewhat obstinately constipated, state of bowels, vomiting more or less persistent, extreme emaciation, diphtheritic stomatitis, percussion-dulness in the supra-spinous fossæ, muco-purulent expectoration, no external cancer discoverable, and all this in a young female,—and yet the peritonitis shall be cancerous, the lungs and bronchial glands being the seat of calcified tubercle only. The tint of skin may be somewhat cancerous, the face emaciated as much as the rest of the body, the peritonitis may be limited, the ascites trifling, and night-sweats and hæmoptysis absent, it is true, in such a case; but to base a positive diagnosis on these points would be rash.*

(*n*) Pleurisy with effusion, which runs a chronic course in spite of ordinary treatment, is, in the majority of cases, tuberculous or cancerous: the character of the symptoms, previously to the occurrence of the pleurisy, will generally decide between the two.

(*p*) But even bilateral pleurisy, with effusion, is not absolutely significant of tubercle; for it may depend on Bright's disease. If the latter affection can be excluded, carcinoma and pyohremia remain as other possible constitutional causes. Besides, as fully shown elsewhere [845], bilateral pleuritic effusion may be simple, and wholly unconnected with diathetic taint.

(*q*) If an adult, free from obvious dysentery, and who has not resided in tropical climates, suffer from obstinate diarrhœa, which goes on month after month, with slight remissions or intermissions, even though there be no cough, he is in most strong probability phthisical. If physical signs, to the slightest amount, exist at either apex, he is, almost to absolute certainty, phthisical.

(*r*) If a young adult, free from secondary syphilis and spermatorrhœa, and not dissolute in his habits, steadily lose weight, without clear cause, he is in all probability phthisical, even though no subjective chest-symptoms exist.

(*s*) If his pulse and temperature steadily range above par, the probabilities, that he is phthisical, grow yet stronger. But he may

* All these facts were illustrated by the case of Scott, U. C. H., Females, ætatis 29, vol. ix. pp. 5-111; the left lung weighed only 9, the right 12, oz. I have since seen two (three) similar cases in young females, one a patient of Dr. Neil Arnott's.

be phthisical, though his temperature, especially in the mornings, fall within the limits of health.

(*t*) Yet he is not by any means certainly so; for he may have latent cancer in some unimportant organ, or he may have chronic pneumonia, parenchymatous or interstitial (cirrhotic).

(*u*) Nay, more, he may steadily lose weight, have dry cough, occasional diarrhoea, and night-sweats, and present dulness under percussion, with bronchial respiration, under both clavicles, and yet be non-phthisical. I have known all this occur both in cases, where the lungs were infiltrated superiorly, on a very limited scale, with primary encephaloid cancer, and where they contained secondary nodules of the same kind.

(*r*) Failure of weight becomes less valuable as a sign of phthisis, the longer the thirtieth year has been passed.

(*w*) A male has some one or more ill-developed physical signs: maintenance of weight at, or closely up to, the normal standard, will as a rule either prove their valuelessness, or at least show that existing tuberculation is slight in amount and quiescent; but it will not invariably prove either one or the other.

(*x*) Abnormal percussion-results at both supra-spinous fossæ, cough, abundant muco-purulent expectoration, hæmoptysis (frequently free from, though sometimes presenting, bistre-colour tint [1203]), great emaciation, apparently inexplicable except on the hypothesis of tubercle, curved nails, and bulbous finger-ends, may all of them exist, and yet not a gray granulation even exist in the lungs. Cardiac disease, chronic pneumonia of the base and pulmonary apoplexy, may alone be present.*

(*y*) The discovery of cardiac disease with marked symptoms deposes against, but does not exclude, the existence of active tuberculation.

(*z*) The existence of cancer in any organ is unfavourable to the presence of tuberculous disease; but tubercle and cancer *may* co-exist, even in the same lung.

(*aa*) Tubercle very rarely, active phthisis still more rarely, co-exists with leucæmia. Concerning acute tuberculation of the lungs putting an abrupt term to the life of a leucæmic patient I have already spoken [1283, *b*].

(*bb*) Constant vomiting of food through the mechanical influence of the cough, the stomach being sound, though much more common in phthisis, may attend chronic bronchitis and cirrhosis.

* Lewis, U. C. H., Females, vol. ix. p. 342.

(cc) Light hair and eyes furnish no argument in favour of phthisis in a doubtful case; the careful investigations of Dr. John Beddoe, undertaken in 500 phthisical patients, on the contrary, go to show that persons with black hair and black eyes are, in proportion to their numbers in the population, the most frequent victims; next to them those with dark brown, and then those with red or fair, hair,—the least liable being those with hair of a medium or lightish brown, and with light eyes.

(dd) An hysterical woman may have frequent, shallow respiration, unpaired percussion-tone, cough, expectoration, peculiar watery hæmoptysis, and night-perspirations; she may lose flesh, and this even especially about the chest, and yet be non-phthisical. The existence of well marked hysterical conditions of the spine, intercostal nerves and skin, coupled with the peculiar watery hæmoptysis and the inordinate frequency of breathing, are valuable guides to the diagnosis. But time must be allowed for distinctive tuberculous decay to occur, before a positive opinion can sometimes be formed in one direction or the other: the thermometer will not settle the question.

And, again, though hysteria and phthisis be, in the main, antagonistic diseases [1283, *d*], the antagonism is assuredly not absolute,—and faith too confident in its reality has more than once led to serious error. It has every now and then happened that an hysterical woman, whose alleged chest-ailments were treated as pure figments, and herself classed with those unwinsome daughters of Eve, who—

*Dans leurs vains chagrins, sans mal tout jours malades,
se font, des mois entiers, sur un lit effondré,
Traiter d'une vieillesse et parfaite santé . . .*

it has more than once happened, I say, that a patient of this kind has died of genuine phthisis, while supposed to be simulating the disease. In one instance, which fell under my own notice, the expectoration of elastic lung-tissue was the first circumstance that *proved* the sufferer was not a malingerer.

1311. Patients frequently attach importance to the determination of the apex most affected. This point may be settled on different principles by different persons. The amount of consolidation in a given spot will guide one; the superficial area of consolidation another; the uniformity of consolidation, or the stage of the disease others. Hence arise sometimes apparent differences of opinion between observers of the same case, where none really

exist. The disturbing influence of emphysema, and the fact that the disease may suddenly become most active at the apex hitherto most quiet, must not be forgotten.

1312. I would here offer, for the sake of beginners, a few cautions in the application of physical diagnosis in phthisis.

1313. Never attempt to give a positive opinion as to the state of the lungs, where there has been recent hæmoptysis, or while pleuritic effusion, bronchitis, or pneumonia is present: I of course refer especially to cases where there may, or may not be, signs of the first stage: if excavation exist, its signs may be generally unravelled in spite of these complications. Always examine the supra-spinous fossæ, as well as the clavicular regions. Trust very little, if at all, to the conditions of vocal resonance; accept with great caution the evidence of slight changes in respiration, unless they be corroborated by percussion-changes; place no confidence in jerking respiration (even though local in any hysterical woman, —nor in harsh respiration, with its prolonged expiration, limited to the right apex in any woman, —nor in very, very slightly abnormal percussion at the right front apex in man or woman. Lastly, never give a confident opinion, in a nicely-balanced case, from a single examination; make examinations in various postures; and always compare carefully with physical signs the local and constitutional symptoms.

TREATMENT.

1314. Experience shows that the treatment of consumptive patients may, with legitimate confidence, aim at either maintaining a *status in quo*, —at producing slight local and general improvement, or marked improvement of this kind, —at effecting a total removal of all subjective symptoms, while the physical signs remain partially active, —or at accomplishing total removal of the symptoms, and bringing about a quiescent state of the physical signs, while the general health, weight, and vigour have improved to such an extent, that the past sufferer shall believe himself totally free from disease, and that the medical observer might be disposed to share his opinion, did not passive physical changes remain. I say medical art may legitimately aim at these ends, because, on the one hand, these ends have been actually obtained; and, on the other, no one has yet appeared who can point to results more perfect than the best of these, as the positive, direct, and traceable effect of any known system of medication. This latter clause is not in the least at variance with the well-known fact, that phthisis

sometimes spontaneously undergoes permanent suspension and practical cure.

1315. The following results, which I obtained at the Consumption Hospital, justify the foregoing statements, and furnish guides to *prognosis*,—supplementary to those already set forth [1303].

(1.) Of a given mass of patients entering the hospital in all stages of the disease, and in every variety of general condition—between the actually moribund state and that of but slight constitutional suffering—the number leaving it, on the one hand, *improved* or *unadvanced* was more than double that, on the other hand, leaving it in a *worse state* or *dying within its walls* (the exact ratio is 67·84 ; 32·16). If the cases in which death was actually imminent at the period of admission, were excluded, the result would be very materially more favourable than this.

(2.) In 4·26 per cent. of the cases, complete restoration to health, not only as regards apparent disturbance of the functions generally, but as regards local evidence of active pulmonary disease, was effected.

(3.) Complete removal of symptoms was more frequently effected in the male than in the female ; but, on the other hand, the results were, on the whole, slightly more favourable in the latter than in the former sex.

(4.) All patients whose condition grew worse, while they were in the hospital, had reached the stage of excavation on admission ; and all patients, whose tubercles were yet unsoftened on admission, left the hospital either improved, or having had a *status in quo* condition kept up. Improvement is more probable than the reverse, even where excavation exists on admission.

(5.) In a given mass of cases, the chances of favourable influence from sojourn in the hospital will be greater, in a certain, undetermined, ratio, as the duration of the disease previous to admission has been greater,—in other terms, *natural tendency to a slow course is a more important element of success in the treatment of the disease, than the fact of that treatment having been undertaken at an early period.*

(6.) The mean length of stay in the hospital in the most favourable class of cases, nearly doubled that in the least favourable.

(7.) The chances of benefit are more in favour of those whose trades are wholly or partially pursued out of doors.

(8.) The results did not appear to be influenced by the laborious or non-laborious character of the trade individuals might have pursued.

(9.) The age of the sufferers did not exercise any very material influence on the character of the results.

(10.) Patients coming from the country have, on an average, a slightly stronger chance of improvement, than the residents of London and the suburbs.

(11.) Patients admitted during the warmer half of the year, benefit by a sojourn at Brompton, to a slight extent more than those received during the six colder months.

1316. The treatment of pulmonary tuberculation will be undertaken with better promise among the well-to-do ranks than among the humbler orders,—though for a time the advantage of management may be more striking among the latter than the former. Lowness of site and dampness of soil seriously obstruct all curative influences.

1317. The phrase “the curable stage of phthisis,” constantly used to designate the earliest morbid condition, while the disease is as yet locally undeveloped, appears to me to signify erroneous views. I do not believe any stage of the disease is more surely curable (in the sense of *curable by art*) than another; and the most satisfactory examples of practical recovery I have witnessed have occurred subsequent to extensive disease. As a general fact, early treatment yields in the majority of the disease, Prop. 5, p. 481.

1318. Such being the hopes with which we enter on the treatment of phthisis, what are our means for recovery?

1319. *Specifics.*—Physicians have tried almost every remedy in their counter-viruses. They have tried arsenic, iron, quinine, and their relationship to the *materia tuberculosa*. They have tried all attempts to found a system of dietetics, and have met with disastrous failures. Iodine, potassium iodide, chloride of potassium, potassæ, chlorine and iron, are under the microscope, and, so to speak, digitalis, are under the microscope. We have made an analysis of their claims to be curative. We have tried the ergot of rye, ergotine, &c., and have found them to be of no credulity, that could have all the credit of the cure. Nor is there a whit better ground for the extravagant laudations of arsenic,—if it were alone set forth as the curative agent. But when we are told that it is curative, we simply exclaim, “No!”

1320. *Antiphlogistics.*—The curative nature of tubercle is not

nature, true to himself, to the last treated the disease antiphlogistically. The counter-doctrine of Louis, rather than the proven mischief done by bleeding consumptive people, first brought such treatment into discredit. But the clinical experience of the profession has long led them to discard the lancet and its attendants from the management of the disease, irrespectively of hypothesis as to its nature. The probabilities are, systematic bleeding will not again become popular. And it is curious enough to observe, how the persons who have translated of late years the doctrines of Broussais and Addison into microscopical language—who see phthisis originating in catarrhal alveolar inflammation, metamorphosed pneumonic products, &c.—join in the general condemnation of antiphlogistic measures by scrupulously avoiding even their mention. If less logical than the real originator of their notions, they exhibit sounder views as to the value of clinical experience.

1321. *Ubiquitous Agents*.—*Cod-liver oil*. I began to employ this oil many years ago, urged to the step by the strong advocacy of Dr. Hughes Bennett, and took an early opportunity of testifying to its remarkable powers in tuberculous and other scrofulous diseases.* The conclusions at which I have arrived concerning its use in phthisis, are as follows—

(1.) That it more rapidly and effectually induces improvement in the general and local symptoms than any other known agent. (2.) That its power of *curing* the disease is undetermined;—I mean here, by "curing" the disease, its power of causing, along with suspension of progress, such change in the organism generally, as shall render the lungs less prone to subsequent outbreak of tubercles, than after suspension occurring through other agencies.† (3.) That the mean amount of permanency of the good effects of the oil is undetermined. (4.) That it relatively produces more marked results in the third than in the previous stages. Opinions the most diverse have been held on this point; M. Taufflieb; taught that it had little or no effect on phthisis, if at all advanced; M. Pörevra§ *reduced the size of cavities in a few weeks*

* *Nature and Treatment of Cancer*, p. 202. 1849.

[illegible]

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Dr. J. G. Bennett de la Philadelph. Revue, 1843.

by its administration. (5.) That it increases weight in favourable cases with singular speed, and out of all proportion with the actual quantity taken;—that hence it must in some unknown way save waste, and render food more readily assimilable. (6.) That it sometimes fails to increase weight. (7.) That in the great majority of cases, where it fails to increase weight, it does little good in other ways. (8.) That it does not relieve dyspnoea out of proportion with other symptoms. (9.) That the effects traceable to the oil in the most favourable cases are: increase of weight, suspension of colliquative sweats, improved appetite, diminished cough and expectoration, cessation of sickness with cough, and gradual disappearance of active physical signs. (10.) That in some cases it cannot be taken, either because it disagrees with the stomach, impairing the appetite (without itself obviously nourishing), and causing nausea, or because it produces diarrhoea. (11.) That in the former case it may be made palatable by association with a mineral acid; and in the latter prevented from affecting the bowels by combination with astringents. (12.) That intrathoracic inflammations and hæmoptysis are contra-indications to its use, but only temporarily so. I have repeatedly given the oil, within a day or two of the cessation of hæmoptysis, without any return taking place. (13.) Diarrhoea, if depending on chronic peritonitis, or secretive change, or ulcerations in the ileum, affords no contra-indication to the use of the oil; even the profuse diarrhoea caused by extensive ulceration of the large bowel is not necessarily made worse by it. (14.) That the beneficial operation of the oil diminishes, *ceteris paribus*, directly as the age of those using it increases,—a singular fact, which probably may one day, when the textural peculiarities of youth and age are better understood, aid in giving a clue to its mode of action. (15.) That the effects of the oil are more strikingly beneficial, when a small extent of lung is implicated to an advanced degree, than where a relatively large area is diseased in an incipient stage. (16.) That when chronic pleurisy or chronic pneumonia exists on a large scale, the oil often fails to relieve the pectoral symptoms. (17.) That it often disagrees, when the liver is enlarged, and probably fatty. (18.) That weight may be increased by it, and yet the local disease go on. (19.) That weight may increase, the cough and expectoration diminish, night-sweating cease, the strength which had been failing remain stationary, under the use of the oil, and yet the local disease be all the while advancing. I have known softening on a small scale pass in two months into tolerably extensive excavation

under these circumstances. (20.) A sensible increase of warmth is experienced by some patients after their dose; but I have not ascertained whether rise of temperature can be objectively proved.

Demonstration will probably be by-and-by obtainable, from the returns of the Registrar-General, of some diminution in the annual mortality from phthisis. Without claiming for the oil the power of curing the disease, we still must look for this result; for indubitably it does possess the power of prolonging phthisical life,—an effect which must of course lessen the annual number destroyed by the disease.*

Of the three kinds of oil,—the brown, light brown, and pale,—the brown, I believe, as matter of actual experience, to be the most efficacious. But, though taken greedily by infants, it is more distasteful than the pale to the adult palate, and hence in grown persons I have been forced to use the latter less active kind (in fact *gild the pill*), in order to ensure oil being swallowed at all.

The influence of the oil on the composition of the blood is yet undetermined. A single analysis by Simon shows a state of hypinosis, combined with a great excess of albumen, may follow on its use,—the solid constituents generally being in large amount. The patient had been bled repeatedly for hæmoptysis.

The iodine and bromine of the oil, its phosphorus, butyric acid, gaduine, biliary material, and its mere fatty matter have been severally accorded the chief part in the beneficial results. Recently the presence of phosphorus has been denied by M. Personne; and M. Winckler seems to maintain that the efficacy of the oil depends on its having propyl for its radical, instead of glyceryl, the ordinary basis of oils. If we accept the pure oleaginous view, whether the oil acts by affording a material to be oxidised, and so sparing the oxidisable tissues,—or by being incorporated with albuminous material, that would otherwise be destroyed,—or through simple deposition,—or in some other unguessed-at way, will still remain matter of conjecture. Meanwhile the established efficacy of the oil—a substance of which *à priori* views would scarcely have

* Dr. John Beddoe has kindly communicated to me the results of a statistical inquiry concerning the above suggestion, which I had made in the edition of 1854. It appears the Registrar's returns do show a marked decrease in the deaths ascribed to phthisis; but at the same time a prodigious increase in those referred to bronchitis,—"So prodigious as to compel me to believe that many cases, now registered 'Bronchitis,' would in 1841 have been set down as 'Phthisis.' Moreover, the number of deaths ascribed to 'Atrophy,' and 'Tubæ Mesentericæ,' is greater than it used to be; and it is among children the apparent diminution of phthisis is greatest." Time will show, if this explanation be just. Meanwhile the fact of decrease in the registered phthisical deaths remains.

admitted the possible retention by the phthisical stomach—is another of the conquests of *experimental* therapeutics.*

The dose of the oil at the outset should never exceed, often fall short of, a drachm; it may be taken immediately before, immediately after, or midway between meals,—the idiosyncrasy of the patient will guide to the fittest time. The vehicle may be water, milk, orange wine, infusion of quassia or chiretta, weak brandy and water, or any aromatic water agreeable to the patient. The dose may be gradually raised to half an ounce, twice, or at most thrice, in the twenty-four hours; I have never seen any good, and often observed ill, effects follow the attempt to pour in large quantities. If there be disposition to regurgitation of the oil, the whole daily quantity may be taken with advantage at bed-time.

If the stomach reject the oil absolutely, it may be administered in enemata, combined with an astringent, or by inunction. I have, however, found that the rectum grows irritated too soon to allow of sufficient continuance of the enemata; through the skin the oil acts more efficaciously.† I have seen much improvement in flesh, and diminution of cough and chest-irritation follow the use of inunction with simple olive oil after the warm bath.

Ozone, if combined with the oil, as suggested by Mr. D. Campbell, slackens the pulse some ten or fifteen beats per minute.

The attempts to prove almond oil, cocoa-nut oil, and neat's-foot oil as efficacious as the oleum morrhue, seem to me to have failed. Skate-liver oil is probably largely mixed with the commercial cod-oil,—and is by some held to be medicinally quite as active.

Some patients, to whom the oil is unbearable, digest cream well: a pint to a pint and a half has been taken daily without gastric disturbance, and with manifest increase of flesh, in advanced cases of the disease under my direction.

But a more important substitute for cod-liver oil is glycerine. The agreeableness of its flavour, the readiness with which it is, when really pure, digested, and its easy combination with the salts

* As is well known, cod-liver oil has been a household remedy from time immemorial in the north of Europe. To the extensive use of fish-oil may possibly be due the singular immunity from phthisis enjoyed by the Esklanders in spite of the anti-hygienic conditions, climatic and other, in which they live [1892, h]. See Schlessinger, B. F. M. C. *lancet*, April, 1891. On the oil contained in the fish depends the faith in the "frozen fish cure" employed in Siberia. See "Revelations of Siberia," by a Battered Lady.

† As is well known, the Romans ranked the process of oiling themselves, and then basking in the sun, among their most important hygienic exercises. The reader will remember the reference to the habit in the letter of Pliny the Younger to Tacitus, describing the catastrophe of Pompeii and the death of his uncle, the Elder Pliny. For very complete details on this point, see the erudite Essay of Prof. Simpson in *Edinburgh Monthly Journal*, 1853.

of iron and quinine,* are arguments deposing less strongly in its favour, than the fact that it often agrees well, when cod-liver oil proves unbearable, and that it very decidedly, in the mass of cases, especially in childhood, increases weight. I have no evidence of its ameliorating special symptoms.

Pancreatic emulsion of solid fat is recommended by Dr. Dobell as at once making up for supposed defect of pancreatic function, and as providing a normal supply of properly prepared fats to be taken up by the lacteals. The preparation is certainly well borne by some persons who are unable to digest, or even retain, cod-oil on their stomachs.

1322. *Mechanical treatment.*—(a) The idea of mechanically dislodging tubercle from the ultimate tubes and cells originated with Giovanni di Vitis, who gave daily emetics with this object. But though the practice has been supported by Carswell, A. T. Thompson, and Burslem, it seems to me as clinically valueless, as it is anatomically unsound. No rigid experience can be appealed to in its favour; it is distressing to the patient, but unquestionably does less mischief, than the morbid anatomy of the stomach in the disease would lead us to expect.

(b) To this class may be referred means employed for lessening the atmospheric pressure under which the patient breathes,—especially the habitation of places at high altitudes. The influence of these places is, however, not simply mechanical, as is fully shown in Part III. of this work.

(c) *Per contra*, instruments have been devised, as that of Ramadge, to cause mechanical distention of the air-cells, on the illogical hypothesis that, inasmuch as emphysema follows, when phthisis spontaneously retrogrades, the artificial production of emphysema will cause the absorption of tubercle.

The compressed air-bath [1020] has been largely tried, especially in France, and according to a conscientious observer, Bertin, of Montpellier,† will unaided occasionally cure phthisis. Without daring to endorse this statement, I can certainly bear witness to the great relief of dyspnoea, cough, expectoration, and constitutional crethism, which may be effected by its cautious employment.

1323. *Encouragement of antagonistic diatheses.*—(α) To this head may be referred the treatment of phthisis by inducing a state of chronic alcoholism. The prophylactic influence of alcohol

* A variety of beautiful preparations are manufactured by Messrs. Price and Belmont, Vauxhall.

† Du Bain d'Air Comprimé, 1850.

has already been considered [1283]; the curative is examined further on [1331].

(b) It seems scarcely likely, the production of *anæmia* will ever, in deference to Trousseau, become a serious object of the physician's ambition [1283, c].

1324. *Iatro-chemical medication*.—Phosphate of lime has been recommended: satisfactory clinical evidence in its favour has yet to be furnished; nor does the theory seem very profound which assumes that, because retrogressive tubercle calcifies spontaneously, ergo, if calcereous salts be taken into the stomach in active phthisis, advancing tubercle will assimilate them, and forthwith retrograde.

The latest plan of medication referrible to the iatro-chemical category, is that suggested by Dr. J. F. Churchill.* The proximate cause of the tuberculous diathesis being ascertained to be none other than decrease of oxidisable phosphorus in the system, the specific remedy becomes obvious,—phosphorus in the lowest possible state of oxidation, and in a form easily assimilable. The hypophosphites of soda and lime (in doses varying from ten to sixty grains per diem) best fulfil these indications. And, in truth, it scarcely appears likely they will be readily excelled, if with the rest of the world, as with Dr. Churchill, they succeed in not only curing the disease symptomatically, but in "removing altogether its physical signs" in 22·3 per 100 of cases in the second or third stages!

But, while most distinctly stating that I have never seen any such results as these, I continue to employ the syrups of the hypophosphites of soda, lime, and iron (especially the latter, as a very easily digestible form of that mineral), having found the general health and the amount of flesh improve under their use.

1325. *Palliative Treatment*.—The following are the agents mainly useful in palliating the sufferings of phthisis.

Counter-irritation, in the various forms of repeated flying blisters, ammoniated liniments, croton oil, the strong acetic acid and turpentine, is an important remedy for the relief of local pain, cough, dyspnoea, and wasting expectoration; tartarised antimony is the least valuable agent of the class. Special irritability of skin and very great emaciation are the only barriers to the employment of such counter-irritation, which I prefer as a rule to permanent blisters, issues, or setons, under the clavicle. The addition of tincture of iodine in variable proportions has appeared to me bene-

* Ranking's Retrospect, vol. xxvi p. 41.

ficial; and a blistering alcoholic solution of iodine and iodide of potassium, cautiously applied, appears not only to relieve pain, but actually to promote absorption,—at least I have found the respiration and percussion-sound improve locally under its use.

Although sceptical as to the solvent theory of its action, I have seen benefit derived from liquor potassæ combined with a sedative and bitter tonic. Digitalis, aconite, and hydrocyanic acid are all useful in cases where the heart is irritable,—checking sometimes, indeed, to a very remarkable degree, various symptoms dependent on that irritability. Where a general state of erethism exists, opium, in some of its forms, must be employed, independently of necessity for it as a hypnotic or anodyne. I have never observed results justifying faith in iodide of potassium as an internal remedy; but the syrup of the iodide of iron, especially if there be the least anæmia, is a valuable medicine; it does not increase fever, and sometimes enables a patient to bear cod-liver oil, who had previously failed in the attempt to take this. Mineral acids, with light vegetable bitters, improve the appetite, and control undue action from the skin. Quinine is often not borne well, and seldom produces any specific effect on the hectic fever; the sulphate of heberine affects the head less uncomfortably.

General experience recognises not only the inutility, but the actual mischief, of bleeding, general or local, with the idea of curing the intercurrent congestions and inflammations of consumption. Doubtless they may sometimes require, both for themselves and to avert their possible consequences, slight local abstractions of blood; but it is remarkable how effectually minor attacks of the kind may be counteracted by dry-cupping, blisters, and antimony.

1326. *Inhalations*.—I have no experience of inhalation of oxygen,* hydrogen, or carbonic acid; and but little of moist inhalations, chloruretted or ioduretted: the latter, I have recently found, relieve some forms of phthisical bronchitis. Inhalation of dry iodine-vapour certainly controls excessive secretion from the tubes,—and has occasionally appeared to improve the constitutional state. The inhaled vapour of warm water, impregnated with emollient herbs, such as *althæa officinalis*, or with narcotic extracts, palliates cough, dryness of throat, and laryngeal irritation.

Inhalations of tar, creasote, and carbolic acid, simple, or in

* Dr A. H. Smith (Dobell's Reports, vol. ii. p. 217) finds that the *primary* effect of oxygen inhalation is to diminish the carbonic acid exhaled and lower temperature, the *ultimate* effect to increase the carbonic acid and the activity of nutritive changes.

association with sedative extracts, have occasionally produced remarkable improvement in the local and constitutional state under my observation.

1327. A palliative influence appears to be exercised in the early stages by the mineral waters of Ems, Oeynhausen, Eaux-Bonnes, St. Sauveur, and Canterets. Eaux-Bonnes should be avoided, where there is hæmoptoic tendency.

1328. *Secondary conditions.*—The secondary conditions of phthisis often require special treatment. *Hæmoptysis* has already been spoken of [1215]. The relief of *cough*, which has resisted small doses of chloral, opiates, and ordinary medicines, may often be effected by the application of three or four leeches above the sternal notch.* *Dyspnoea* may be mitigated by inhalation of small quantities of chloroform.† Naphtha sometimes succeeds, sometimes fails, in diminishing *expectoration*: when successful, hæmoptysis may be the immediate result.

Nausea and vomiting may be controlled by effervescing draughts, Seltzer water, plain iced water, by prussic acid, or by a combination, which I have found very useful, of creasote, stramonium and hop; if there be acidity, by liquor culcis or liquor potassæ; by blisters and sinapisms; or, if essentially nervous, by oxalate of cerium; if there be tenderness, by leeches to the epigastrium. *Diarrhœa* may be arrested by soothing laxatives (rhubarb with magnesia, or castor oil, cajuput, and tincture of opium) when dependent on irritant matter in the bowel. Sometimes diarrhœa, without evidence of inflammatory action, is more or less amenable to the whole class of astringents,—among which I may specially refer to sulphate of copper and opium, kino, bael and acetate of lead; and enemata of starch and laudanum, or of hæmatoxylin, krameria, eucalyptus rostrata, or tormentilla. If there be evidences of sub-inflammatory action, friction of the abdomen with rubefacients, or the application of a few leeches either to the tender part of the abdomen or to the anus, sinapisms, blisters, and emollient poultices, are advisable. The hip-bath is very hazardous. Where the large bowel is extensively ulcerated, remedy after remedy will probably be tried in vain. I have seen some benefit, even in these cases, from the sulphate of zinc in two grain, and the nitrate of silver in one grain, doses: enemata of the latter, in solution, are also sometimes useful. In all forms of diarrhœa, except when it has become confessedly irremediable, the

* Hall, U. C. H., *Femaler*, vol. ix. p. 128.

† Spencer Wells, *Med. Times*, Oct. 11, 1851.

diet should be low and as dry as possible : attendant thirst may be mitigated by dissolving pieces of Wenham-lake ice in the mouth.

Perspiration may be controlled by avoiding much drink and using light bed-clothes ; the chest may be rapidly sponged at bed-time with tepid vinegar-and-water, or with decoction of oak-bark. Bark, zinc, the mineral acids, gallic acid and lead, have, as medicines, the most perceptible effect. But, too often, all efforts to control the cutaneous flux fail. I know not whether the theory be sound, or the practice likely to succeed, which have lately been put forward by Dr. E. Smith, who argues and advises thus :—"As profuse perspirations occur in phthisis during sleep, and as, during both day and night sleep, the pulse is lowered, and that to a very great extent in the night, it is probable that the former must depend upon the latter. With this impression I have administered food with wine or cold tea in the night with great advantage in preventing the perspirations."*

Inflammatory and ulcerative changes in the larynx may be stayed by local leeching, blistering, counter-irritation with equal parts of spirits of turpentine and croton oil,† or an issue to the side of the neck or nucha.

Further, considerable relief of laryngeal irritation, improvement of the voice, diminution of dysphagia and an easier condition of breathing may be obtained, in the laryngeal affections attending phthisis, by sponging the back of the pharynx, the epiglottis and the confines of the upper orifice of the larynx with a solution of variable strength of the nitrate of silver. Even when considerable destruction of the mucous covering of the vocal cords exists, relief is sometimes, at least, for a while, obtainable by this means. The chest-state is even relieved by the lessening of the cough. But how stands the evidence as to the alleged utility and practicability of sponging the interior of the larynx itself, and of injecting the bronchial tubes and the interior of pulmonary excavations? The following are the inferences which I feel warranted in drawing from my own observation, fortified by the extended experience of others :—

(a) No proof exists, that the interior of the larynx, at and below the true vocal cords, has ever been reached with the sponge and probing in the living subject. The feat is of most difficult accomplishment in the dead body,—an amount of force being required,

* Med. Chir. Trans., vol. xxix. p. 190.

† This combination must be very cautiously used, — three or four drops only being rubbed in with a piece of flannel for a single minute at a time.

which would be utterly unjustifiable in the case of the living person. (b) The utter fallacy of supposing that, because a hollow tube, passed beyond the root of the tongue, influences the flame of a candle held before its external orifice, therefore the internal end of that tube has reached the trachea, has been fully proved. It has been shown that if a hollow tube be purposely pushed into the cesophagus, almost to the cardiac orifice of the stomach, the flame of a candle will be drawn to or blown from the orifice with inspiration and with expiration.* (c) I have made numerous attempts with a curved silver catheter, provided with a gutta-percha hollow bell at the external end,† to reach the trachea. But I have never felt satisfied I had succeeded; though I can conceive, that if the glottis were caught, unawares, an instrument might be slipped in without injury to the cords.‡ Again, in one single instance, *where the vocal cords had been almost totally destroyed*, the fact that distinct resistance was felt in withdrawing the probang, the sponge escaping outwards with a noise resembling that heard in drawing a cork, leads me to think, where the constrictive power of the cords is annulled, even the sponge may by a sort of accident be inserted below the rima. (d) There can be little doubt, that the failure to reach the interior of the windpipe is matter for congratulation to both patient and operator. For occasionally an unusually large quantity of the fluid injected from the catheter, accumulates about the upper part of the larynx, and not being instantly sputtered away by the convulsively energetic cough that ensues, a few drops make their way into the larynx. The terrible suffering that follows, and holds on in a more or less aggravated form for some while, shows that disastrous results must follow, were any quantity of the caustic fluid really thrown into the tubes. (e) In a word, it appears to me, the alleged injection has never been demonstrably executed; and were a process invented by which it might be effected, I believe its execution would be unjustifiable.§

* Results of New York Commission, confirmed by Erichsen, "Science and Art of Surgery," 2nd edition, p. 751. The experiments of Professor Griesinger, of Tübingen, on this point, are peculiarly interesting and conclusive, for he started on his inquiries with the conviction, subsequently most fully and candidly relinquished, that the introduction of a catheter below the vocal cords was easily to be effected (Deutsche Klinik, April 17 and July 17, 1858.)

† Made by Coxeter, Grafton-street East

‡ It has, indeed, been shown that in certain quasi-anæsthetic conditions, as in the apyrexial stage of croup, a tube may be passed into the larynx and retained there for a day or more.

§ An eminent teacher, Dr. Hughes Bennett, thinks otherwise, however he believes the sponge may be thrust "through the rima into the larynx, and frequently into the trachea;" and seems to think the operation only requires a little dexterity. "On Pulmonary Consumption," 2nd edit., p. 206 1859.

A surer and more efficacious plan of topically acting on the larynx and throat is by some form of spray-inhaler: that of Siegle among the most readily manageable. Alum, tannic acid, iodide of potassium, tincture of iodine, of perchloride of iron, &c., may be thus used according to the particular indications.

Chronic peritonitis requires the application of leeches, and blisters, which may be dressed with morphia, when the pain is severe, and friction with ioduretted liniments; emollient poultices with laudanum, if not too thick and heavy, relieve pain. If there be marked ascites, diuretics are indicated; but they often fail. In point of fact, this is one of the conditions of tuberculation the least really controllable by art; though it sometimes undergoes a peculiar kind of spontaneous cure [1267]. Cod-liver oil, if not already in use, should, of course, be administered: the existence of diarrhoea is not a contra-indication.

Tubercular meningitis is yet more difficult of cure; moderate local bleeding, constant cold irrigation of the head, *stillatum*, counter-irritation, purgation, and other revulsive measures, and calomel internally, are alone to be trusted to. I have as yet seen but one even apparent example of recovery in an adult, where the symptoms of tubercular meningitis seemed established: a few prominent particulars of the case may here be given.

John Stoner, æt. 25, admitted U. C. H. for second time, in third stage of phthisis, April 14, 1849. The chest disease gradually advancing. *June 2* Peculiar mutism [1275], semi-stopor, is with difficulty roused, dysphagia, drink pouring back through mouth, but not nose, pupils sluggish, no distinct convulsion, lower extremities drawn up, anal. paralysis, sensibility blunted, fixed frontal cephalalgia; seems conscious of all that is passing around him: P 102, R 44. — *June 4* Since this seizure, cough almost gone, scarcely any expectoration, alternate pallor and flushing of cheeks; no rigidity or convulsions, no screams, no strabismus, complete insensibility of dorsum of hands; yet lency to rigidity of knee-joints; fingers firmly clenched, when unclenched by bystander contract again, P 142, R 44. — *June 5* Sensibility returned, still speechless. — *June 2* Spoke as usual for first time. This man was treated with mercurials, but not to pyæmia. Discharged on July 13th, he was readmitted August 18th, and died of his pectoral disease, the cerebral functions being perfectly natural, on October 11th, 1849. *Post-mortem*—No morbid appearance at fissures of Sylvius, over both anterior lobes fine florid injection; numerous granules, opaque, greyish white, size from pin's point to pin's head, beneath cerebral arachnoid of these lobes, convolutions here appear drawn together, as if from deep seated contraction in the sulci; membranes here generally opal scent; dura-matral arachnoid adherent posteriorly to cerebral arachnoid of left hemisphere, membranes thicker than natural, anterior convolutions at the crive forwards, especially at left side, somewhat opaque, those of left side not materially softened, those of right firmer than natural.

I have since found calcareous matter in the pia mater of the sulci in a person cut off by phthisis.*

Should *fistula in ano* be operated on in phthisical or in phthisi-

* Diamond, U. C. H., *Males*, vol. iv. p. 335.

cally disposed persons? As far as my experience goes, it deposes emphatically against interference in one class or the other, unless, what is rare, there be wasting discharge from the sinus and serious local and general suffering. I have more than once known the pulmonary disease freshened in activity by successful operation for fistula. Inasmuch as these abscesses are lined with a coating of cheesy tuberculous material, it is not illogical to regard them, with Thiry,* as a probably beneficial drain.

1329. *Hygienic management.*—Equal in importance to the medicinal treatment of the consumptive is their hygienic management. We proceed to indicate the various aspects under which valuable aid may be afforded to these sufferers by attention to extrinsic conditions.

1330. *Atmosphere.*—Pure, warm, dry air is that suggested by theory, and proved by experience, to be the best adapted for the tuberculised lung and phthisical system. The climate of our own island is, in the winter months, for a variety of reasons, much more from its fog, damp, gloom, and changeableness than its absolute cold,† unfit for the consumptive invalid. The subject of change of climate, by land and sea, is so important that we have devoted a special division of the work, Part III., to its consideration.

Where circumstances render change of climate impossible, the winter may be passed, comparatively without danger, in-doors in England in an artificially managed atmosphere, provided proper precautions be taken in regard of ventilation. Air heated to a fixed temperature,‡ and perpetually renewed by a scientific system of ventilation, such as Dr. Neil Arnott's, forms an excellent substitute for the naturally soft air of milder climates than our own. If, on the one hand, there be the drawbacks of fog, gloom, and want of open-air exercise, there are the counterbalancing advantages of the comforts and familiar friends of home, and the escape from the privations and labour of travelling,—advantages which, there can be no question, prove to persons of some temperaments immense.

* *Presque Médicale Belge*, 1861. See also Quain, *Diseases of the Rectum*.

† Absolute cold, provided the air be excessively dry, and yet better, if it be in addition still, does not disagree with a certain class of phthisical sufferers, the bright clear atmosphere of Canada, Minnesota, and even Sweden has with many experienced been some well. But for a variety of reasons these are places to which no one could willingly consign a phthisical sufferer from this country.

‡ Some latitude may be allowed, of course, for individual taste, but, as I found from questioning upwards of one hundred patients at the Brompton Hospital, an in-door atmosphere at all below 54° Fahr. is disagreeable to the majority.

The arrangements of the tropical department of the Crystal Palace at Sydenham, as affording a genial, yet not over-close, atmosphere for the exercise of the consumptive invalid, have not, perhaps, been utilised to the extent they deserve.

Whether there be any atmosphere specially fitted for the consumptive, irrespectively of its meteorological characters, is yet matter for inquiry. The air of the Mammoth Cave in Kentucky, of extreme purity and specifically exhilarating properties, is unfortunately of low temperature: besides, the absence of sunlight will probably prove fatal to the success of its phthisical Sanatorium. The rapid fattening of the lower animals in the Cave, independently of any change of food, seems an established fact.

1331. *Diet*.—The diet of the consumptive should be simple and nutritious; very strict rules as to special articles of food are uncalled for, unless the stomach have exhibited signs of imperfect power. It is advisable, however, to encourage the ingestion of fat. Dr. Hooker affirms that "of persons dying of phthisis between the ages of 15 and 45, nine-tenths at least have never used fat meat,"—and further that the few persons, who, having eaten fat freely, nevertheless become phthisical, derive no benefit from cod-liver oil.* As respects the quantity of animal food allowable, no general rule can be laid down; so much as each stomach can digest, without local suffering or systemic disturbance, may not only be safely permitted but positively recommended. Without being an advocate of the forced "mutton-chop and porter" plan, I am perfectly convinced that a low diet is seriously injurious.

In the ordinary class of phthisical patients, I have not, as a rule, observed ill effects to ensue from the tempered use of stimulants,—wine, spirits, or sound malt-liquor, according to the previous habits of the individual. If, however, these agents excite cough, increase the frequency of the pulse, or cause excitement, they probably do more harm than is counterbalanced by either the sense of increased vigour and general comfort they passingly bestow, or by the theoretical views that will by-and-by be adduced in their favour.

But in special and exceptional cases of phthisis, either apyrexial or attended with very slight febrile reaction, the claims of alcoholic beverages to the consideration of clinical observers become very much stronger. In examples of the disease of this class, marked by habitual coldness of the skin, lividity of face, dyspnoea, and general languor instead of the constitutional erethism com-

* *Trans. Amer. Med. Assoc.*, vol. viii, 1855.

monly characteristic of phthisis, I have prescribed brandy medicinally in daily doses varying from half an ounce to two ounces, with the good effect of temporarily raising the temperature, lessening the lividity of surface, and relieving the dyspnoea. Perhaps the notion, that brandy supplies pure aliment for respiration,* may explain the fact, that habitual spirit-drinkers (*placed otherwise under favourable hygienic influences*) do sometimes suffer less, and live longer, with excavated lungs, than sober persons. I have seen some three or four most remarkable examples of the kind,—examples, indeed, which first led me to a cautious use of brandy medicinally.†

And, in truth, there are apparently strong *a priori* grounds for the moderate use of alcohol in phthisis generally. Bucker found that a tea-spoonful of *spirits of wine*, taken daily, led to a diminution in the quantity of the solid and fluid urinary excreta, as also of the carbonic acid exhaled by the lungs. No increase in any other of the excreta took place,—and therefore the inference seems unavoidable, that alcohol saves waste of tissue.‡ But sugar and gum-arabic seem to exercise similar effects, while their consumption is not open to the grave moral objections that attach to alcoholic fluids; they should be allowed largely as articles of food at once calorific, and, if not directly, at least indirectly, plastic.

The mucilaginous material of the Carragheen and Iceland mosses is useful, as satisfying appetite somewhat without exciting the pulse.

Donkey's milk is very readily assimilated by the phthisical stomach, and aids distinctly in nutrition; caution in its use is requisite in London, in consequence of the noxious manner in which the donkeys are sometimes fed. Galen§ recommended

* But this idea is contested by some experimentalists, and the influence of alcohol over tissue metamorphosis is very variously stated by distinguished and pains-taking observers.

† Dr. Stokes relates a striking example of recovery from phthisis (very local and general symptoms existing in the highest degree) in the instance of a gentleman, who, knowing he had been condemned to die, determined to enjoy his brief tenure of life in his own fashion,—the great element of his happiness consisting in the consumption of *solidus less than seven tumblerfuls of whiskey punch per diem*. (Phil. Med. Press, Nov., 1844). Now it is plain enough, a single case of this kind wholly fails to prove the curative powers of alcohol, for it may fairly be alleged, that recovery in this exceptional character does every now and then take place under all conceivable varieties of combination of hygienic and medicinal conditions. But, on the other hand, the case suffices to show beyond the possibility of doubt, that where the disposition in the phthisical system to arrest and repair is strong, even outrageous abuse of alcohol will not counteract or even injuriously modify, that disposition.

‡ How then can it be affirmed that alcohol is not, at least indirectly, a food?

§ Cabanis, *Rapports du Physique et du Morale*, p. 475, ed. Paris, 1843.

lactation by a robust woman; and I have known the plan apparently prolong life.

Sarsaparilla agrees well as a diet drink, and occasionally acts beneficially as an alterative.

1332. The habit of smoking, if indulged in with moderation, has not appeared to me specially injurious in phthisis; it is not impossible, indeed, that the infinitely minute quantity of nicotin inhaled, may exercise a locally soothing effect. But the profuse use of tobacco is decidedly injurious to the health of the phthisical, as of the non-phthisical.

1333. Moderate and frequent *exercise* in the open air, either active (riding or walking), or passive (carriage, swinging, or yachting), is essential.* Gentle gymnastic exercises (the so-called Musical Gymnastics more particularly),† acting mainly on the upper extremities, the use of light dumb-bells, and in childhood of the "chest-expander," help to counteract the tendency of the disease to diminish the volume of the lungs. So, too, does the practice of taking deep inspirations, of reading aloud, and of moderate singing; any evidences of implication of the larynx would of course render quietude of that organ essential.

1334. The *bath*, tepid or warm in cold weather, cool in the summer, should be used twice a week, and followed by free friction of the skin, with or without subsequent inunction, local or general. Concerning the specific utility of the Turkish bath I am yet undecided; facts are wanting.

1335. *Dress*.—Flannel should be worn next the skin; but several layers of such covering, often seen, especially among the humbler orders, are useless. All compression of the thorax by stays, or otherwise, should be avoided.

I have seen most severe inflammation of the epiglottis follow, within twenty-four hours, the removal of beard under the chin:‡ a full amount of hair about the mouth and throat affords a protection not to be despised.

1336. *Profession*.—Exchange of profession or trade, from the sedentary and laborious, to those moderately active physically, and but slightly taxing the intellect, is advisable.

1337. *Marriage*.—(a) Medical counsel will often be sought by consumptive persons, as to the propriety or feasibility of marriage. The question obviously concerns not only the phthisical individual,

* Unfortunately, however, we can no longer profess: "Bark is no surer cure for ague, than riding is for phthisis." Works of Sydenham, vol. ii. p. 296.

† Vide Lecture by M. C. Tyler, M. A. 1864.

‡ The patient had just returned to town from Algiers in the month of May

but also the proposed husband or wife, the expected progeny, and to a certain degree the State. First: of the legal competence for marriage of the phthisical there can be no doubt. The sexual aptitude of the male is certainly not seriously weakened, though the seminal fluid may be impaired in potentiality, and the procreative faculty, as I have already stated, reduced [1256]: the fecundity of the female exceeds the average.* That, especially during the earlier periods of the disease, frequent sexual excitement of necessity exercises a damaging influence on the phthisical, I possess no proof; but I have had cognisance of one case where hæmoptysis, occurring *in actu coitus*, proved "indirectly" fatal.† Secondly: marriage cannot, in the present state of knowledge, (no matter how strong our convictions), be *logically* discountenanced on the ground of *proven* infectiousness of the disease; and whether the toil and privations, and probable impairment of health, entailed by the prolonged nursing of an individual specifically diseased, shall on the one hand be inflicted, and on the other hand be accepted, is a matter on which the pair immediately concerned are alone entitled to decide. Thirdly: a couple, of whom one is phthisical, marries with the calculated surety that, on the lowest computation, a proportion, variously exceeding 26 per 100 of their offspring will inherit the same disease.‡ Beyond this, the chances of rickets, and of the external acknowledged forms of scrofula, exist in a certain but undetermined ratio. Nor is idiocy to be forgotten as a possible infliction; out of 484 idiots, observed by Dr. Maxwell at Redhill, 14 (out of 86 who were fatherless, motherless, or both) had lost a parent from phthisis,—a considerably greater number than that from any other individual disease. Fourthly: a State

* That there exists a greater proneness to early marriage among the phthisical than the non-phthisical appears to follow from the subjoined table from the author's Report on Consumption (l.c. cit.).

Table showing the proportion of the total number married who were under *ætat.* 35

Percentage of total number married who were under <i>ætat.</i> 35	PHTHISICAL		NON-PHTHISICAL	
	Males.	Females.	Males.	Females.
	47 86	57 69	30 13	40 24

I have seen a few cases which lead me to suspect that, oftener than is imagined, the phthisical hasten their marriage, not from the cravings of passion, but *because they know, or at least strongly fear, their lives are destined to be short*.

† Virchow (l.c. cit.) has seen "several cases" where consumptives who had been abstemious before marriage, were, after marriage, rapidly attacked by tubercle of the prostate gland; tubercular endometritis not unfrequently residing in the prostatic process in tuberculous women according to the same writer, (Dobell's Reports, vol. ii. p. 102.)

‡ Plainly so, inasmuch as 26 per 100 is my actual calculation for the *adult* hospital population of this country [1299].

may perhaps on first thought be supposed rather to lose than to gain by the addition of tuberculous units to its population; but so widely is the phthisical element diffused among us, as among many continental peoples, that if tubercle were regarded as a barrier to marriage, a diminution in the numbers born, sufficiently sensible to prove of serious political import, might shortly be anticipated.

From the active fecundity of the phthisical female, as compared with the relatively feeble procreative powers of the phthisical male [1256], it follows that the marriage of the tuberculous female inflicts a greater amount of mischief than that of the male.

(b) On the other hand does the grave development of phthisis, in either individual of a pair, who have contracted to marry, furnish an efficient plea, either to the non-phthisical or to the phthisical of the two, for refusal to fulfil that contract? It must be taken for granted, the existence of phthisis has only become apparent subsequently to the engagement.

Now to the non-phthisical contracting party, the dangers of uniting with a tuberculous consort are certain,—though they do not, as a matter of strict demonstration, involve that of infection. Besides, conscientious scruples may very conceivably arise, as to the morality of taking part in a union, the proceeds of which must come into the world with a fixed, calculable chance of being phthisical, rickety or idiotic. But the question has not, that I am aware, been ever submitted to a legal tribunal in this country; and it may be doubted that, conceding the plea might satisfy a jury, it would stand good in point of law.*

As concerns the party to the contract, who has become phthisical, all will depend, in the medical point of view, on the conditions of the disease. If tuberculisation have reached an early stage only, and, more especially, if the local and general symptoms be of mild character, the pulmonary affection clearly furnishes no legitimate ground of severance of contract. But if the general suffering be grave, if asthenia be carried to extremes, and if there have occurred attacks of hæmoptysis, *per se* more or less dangerous to life, it seems to me unquestionable, that a fair medical plea for non-fulfilment is established.

And, accordingly, I gave evidence to this effect† in a remarkable cause, the only one of the kind on record, where the male

* Justice Williams seems clearly to hold that the female might decline to fulfil her contract, if the male had become gravely enfeebled by phthisis, on the ground of his presumed sexual inefficiency. (*Law Times*, Jan. 7, 1866, p. 234.) But the question of substantial inefficiency could only be decided by medical evidence.

† In conjunction with Mr. Mackie, of Hinghamton.

defendant, far advanced in active phthisis, pleaded that the fulfilment of the contract would endanger his life.* The jury found "the facts true," and gave a verdict in his favour. But various points of law arose, the main one being, whether the defendant was justified in withdrawing from his contract, because its fulfilment would have placed his life in jeopardy. The question seems to have thoroughly puzzled the Bench,—six learned judges deciding in the negative, five in the affirmative,†—the cause now (February 1860) standing in such position, that the defendant, cast by a majority of one, may appeal to the House of Lords, and "either party be at liberty to apply, after the appeal to the House of Lords has been determined,"—and this, after two years' litigation! Meanwhile to the mind, unversed in forensic subtleties, the argument, contained in the judgment delivered by Chief Baron Pollock in favour of the defendant, seems of irresistible cogency.

1338. *Segregation.*—Although, as I have admitted, the reality of infection be logically unproved, it is wise to segregate the actively phthisical as far as possible; the inspiration by the healthy of the exhalations of the diseased, cannot fail to be constitutionally, if not *specifically*, injurious. A phthisical patient should not be permitted to occupy the same bed as a healthy person;—especially when the expectoration is purulent, profuse and nauseously odorous.

(III.)—ACUTE PULMONARY CONSUMPTION.

1339. When phthisis proves fatal in from twenty days to ten or twelve weeks from the first appearance of symptoms, it may fairly be said to have run an acute course.

1340. Phthisis, passing thus rapidly through its clinical phases, may be either a primary independent disease, or, appearing in the guise of a secondary affection, hasten the fatal termination of some pre-existent complaint.

(A.)—PRIMARY ACUTE CONSUMPTION.

1341. *Anatomical characters.*—In cases of death from primary acute phthisis, I have seen the three following anatomical states:

* Hall v. Wright, before Justice Erle, Queen's Bench, Dec. 1857.

† *Sittings in Error*, from the Queen's Bench, "Law Times," Hall v. Wright, p. 230, January 7, 1860. Unfortunately the legal technicality of the defendant's having, or not having, given notice in proper time to the plaintiff, of necessity mixes itself up with the broader views influencing the decision of some of the judges. Long before the Bench announced its opinion, the death of the defendant had taken place (May, 1859); so that, as one of the judges observed, "the defendant's plea was, he could not marry without dying, but he died without marrying."

(a) Limitation of tuberculous deposit, softening and excavation to the apices, just as in ordinary chronic phthisis,—no peculiarity existing in the anatomy of the disease to account for the rapidity of death,—which, however, I have not observed, in this form, earlier than the eleventh week.

(b) General accumulation of crude tubercles or tuberculous infiltration of lobules, through both lungs, with irregular softening, small excavations existing in various parts, and patches of hepatisation presenting themselves here and there (*acute infiltrating, caseous or pneumonic form*).

(c) General studding of both lungs with semi-transparent grey granulations, coupled with the earliest stage of pneumonia, that of bright arterial injection [1061] or with hepatisation (*acute miliary form*),—or with normal coloration of tissue.* The forms b and c may coexist in the same lung.†

The third form (c) is, more especially than the others, characteristic of genuinely acute phthisis: and will be treated of in the present place; the second form (b), will be considered under the head of caseous pneumonia [1350]. In the first case (a) there is nothing peculiar in the signs and symptoms: the progress of the disease, except in regard of its rapidity, is exactly the counterpart of that observed in chronic phthisis; and a lurking suspicion frequently remains in the observer's mind, that tubercles may have existed in the *latent* state, for a greater or less time, before the outbreak of symptoms.

ACUTE MILIARY TUBERCULISATION.

1342. *Physical signs*.—*Inspection, application of the hand, and mensuration* give the same results as in acute primary congestion of the lung; these have already been described [1066].

So, too, of *percussion*. At the outset the mass of tone may simply be increased with fall in pitch,—in fact, the sounds present an exaggeration of the characters of health. This will especially be true, if acute emphysema (as is not very uncommon) attend the miliary deposition. If there be dulness of percussion-note sufficient for positive detection, the condition would deceive rather than otherwise; it would depend not on the miliary deposit, but on some superadded morbid process.

The *respiration* uneven, harsh, high-pitched, mingles here and there with dry, or with fine bubbling, bronchial rhonchi. Vocal resonance gives no sign.

* Tillman, U. C. H., *Males*, January 1858.

† Knowles, U. C. H., *Males*, vol. x. p. 18.

1343. *Symptoms.*—The symptoms are those of a febrile affection, with more or less positive functional implication of the lungs.

The invasion, sometimes occurring in a state of apparent health, or preceded remotely by various depressing influences, such as anxiety of mind and over-toil, and immediately by exposure to cold and wet, is marked by rigors, followed by acrid heat of skin; the rigors may recur on several successive days, and there may subsequently be perspirations with abundant crops of sudamina. I have seen one or two specks on the abdomen, having some, but by no means all, of the characters of the papular special eruption of typhoid, or Peyerian, fever;* and wholly doubt the correctness of an opinion ascribed by Leudet† to Waller, of Prague, that the true lenticular spots of that fever are to be found in some cases of acute phthisis. Petechiæ do not appear. Epistaxis, followed by coryza, may occur on the second day of seizure.‡ Prostration sets in early,—in a few days the patient may be unable to stand. Thirst; total anorexia; epigastric tenderness; dry lips and tongue; dental sordes; all signify digestive disturbance: but the form of the abdomen is natural, there is no gurgling in the iliac fossa; diarrhœa is rare; and constipation may be extreme. Restlessness, insomnia, cephalalgia, vertigo, tinnitus aurium,§ diurnal wandering and nocturnal delirium, bespeak cerebral sympathy.

Pain in the chest, variable in seat and never intense; cough (sometimes preceding, sometimes following, the fever in order of development) paroxysmal or not, and either absolutely dry or accompanied with expectoration of clear or yellowish and opalescent mucus, or in rare instances of viscid sputa, slightly stained with blood, without actual hæmoptysis; dyspnœa of considerable amount, indicated not only by the absolute frequency of breathing, but by perversion of its ratio to the circulation, and lividity of the face, constitute the chief of the thoracic symptoms.

The relationship of the pulse to the respiration, however, varies; the average, in my cases, has proved 3:1; but I have known it once fall to 1.45:1 (80:52).|| The heart and its membranes remain unaffected. The urine, of medium specific gravity, has the characters of febrile urine generally; it contains neither albumen nor sugar.¶

* Garrett, U. C. H., *Females*, vol. vi. p. 146; May 3, 1851.

† *Phthisis Aigue*, Thèse de Paris, 1851. Leudet does not share in the opinion.

‡ Garrett, U. C. H., *loc. cit.*

§ Garrett, U. C. H., *loc. cit.*

|| Garrett, *loc. cit.* But there were here some hysterical symptoms; and the ratio was changed to one of 3:1.

¶ Garrett, *loc. cit.*, pp. 150, 151.

1344. *Diagnosis*.—(a) I know of no means by which the addition of miliary tuberculation to *florid arterial congestion* may be surely inferred. As we have seen, the diagnosis of this form of acute congestion is itself beset with difficulties [1069],—and all that can be said is that, when the evidences of such congestion are presumedly conclusive, great caution in foretelling its issue must be exercised.

(b) At the very outset, and especially as days wear on, miliary tuberculation may be mistaken for *acute asphyxiating bronchitis*. But in the latter affection there is no noticeable rise of temperature, in truth the skin is warm only, or even slightly cool and moist, its colour generally cyanotic or livid; bronchial rhonchi, dry and moist, are more abundant than in acute phthisis, and the moist class most prevalent in the former disease inferiorly, in the latter often superiorly; the pulse-respiration ratio is less perverted in primary bronchitis than in acute phthisis; in the former full muco-purulent expectoration soon occurs, fails to appear in the latter. Neither the percussion-note nor the respiration-sounds afford positive help in the distinction of the two diseases: *in both affections the percussion-results may to the last maintain the attributes of health*.

(c) The distinction from *pleurisy* is easy. The absence of friction-sound, and of the sequential dulness, with the whole cohort of physical signs renders error well nigh impossible after a day or two.

(d) As to *pneumonia*: if, for the first two or three days, the perverted ratio of the respiration and pulse might suggest the diagnosis of that inflammation (which, be it observed, exists in a certain state), the lapse of twenty-four hours will prove the absence of the common idiopathic form of that disease,—for the signs of hepatisation are not an iota more obvious than on the previous day.

But singularly enough, the chief chance of error is not to be found in pectoral disease; certain affections, *primâ facie* most unlikely to be confounded with acute phthisis, affections holding no direct relationship with the thorax, are precisely those of which the satisfactory distinction may prove most difficult. These are typhoid (Peyerian) fever, simple meningitis, delirium tremens, pyohæmia, and acute glanders.

(e) The simulation is closest, and hence the clinical difficulty greatest (the question has already been touched upon by Louis) in the case of *Typhoid (Peyerian) fever*. Dyspnoea, prostration, bronchitic rhonchi, dusky face, febrile action, dry skin,

adynamic state of the tongue, delirium, and stupor, not only exist both in miliary phthisis and in Typhoid fever, but may do so to similar amounts. If pneumonia be present, it affords no help in the diagnosis: for it may be supposed secondary to the typhoid fever. The abdominal symptoms and the peculiar eruption of typhoid fever draw the line, to all appearance, positively,—but only in appearance: for abdominal symptoms and enlargement of the spleen may be present in acute phthisis, if the intestine be undergoing acute tuberculisation: and although eruption probably exists in all cases of typhoid fever, it certainly escapes detection, possibly from its slight amount, in a few instances, and besides spots simulating those of typhoid fever may form in acute tuberculisation. All these difficulties were well illustrated by a case, of which I subjoin the main facts:—

H. Manning, admitted U. C. H., Aug. 9, 1850 (Males, vol. v. p. 168), ætat. 23 (unable to give account of himself, subsequently known from friends to have been taken ill July 13); prostration, stupor, dingy face, nails livid, skin warm, P. 120, R. 42, tongue dry and cracked, sores on teeth, *spleen* 1½ hand's breadth high, tenderness in right iliac fossa, abdomen of medium prominence and generally tender, *diarrhoea* for last two days; no sudamina; no distinct typhoid specks; general percussion dullness at left base, with difficult blowing respiration, same signs less marked at right base; sputa viscid, somewhat transparent, of faint tobacco-joint tint; heart's size and sounds natural. *Diagnosis: Typhoid fever, with secondary pneumonia* (the difficulty about the want of eruption being noticed at the time). *Tenth*, Aug. 14 (the 28th day). There was double hepatitis mainly of the lower lobes, and the entire of both lungs were profusely studded with semi-transparent gray granulations (some growing opaque in the centre), a stratum of recent lymph in the left pleura was similarly studded; the spleen, 6 in. high, weighed 11 oz.; liver fatty; Peyer's patches contained crude yellow tubercles, here and there, size of pins' heads.

The obscurity, thus arising from tuberculisation of the intestine, has not been referred to, so far as I know, by any author. But here is even a more difficult combination. A maid-of-all-work, aged twenty-one, about one year in London, is seen, on from the seventh to the tenth day of an acute attack, unable to stand, somewhat thinned (having, on the second day, had epistaxis, followed by coryza); with brown furred tongue, epigastric tenderness, slight vomiting, one or two doubtful typhoid specks on the abdomen, vertigo, trinitus aurium, cough, with very little expectoration, slight limited dullness at both posterior bases, a pulse-respiration ratio of about 1:56:1 (80:52), and constant decumbency on the back. It is true, neither gurgling in the iliac fossa, diarrhoea, nor sudamina, existed; but the two first are often wanting in typhoid fever; and it was too early, on the seventh day, to expect sudamina, on the hypothesis of typhoid fever. The pulse-respiration ratio was valueless, because the woman had hysterical hyperæsthesia of the skin. Yet this case shortly

proved to be one of acute phthisis, running a peculiar course, to be by-and-by referred to; the meninges were free from granulations.*

(f) Where mingled excitement and adynamia are more than usually marked, acute phthisis might be mistaken for *acute simple meningitis*; but the following characters of the latter disease will be wanting,—vomiting at the outset, incoherence, violent delirium, wild glistening eye, photophobia, and intolerance of sound, strabismus, alternate flushing and pallor of the face, convulsions, and muscular rigidity or paralysis.

(g) I once saw a patient after a week's illness (a hard drinker, who had frequently had attacks of *delirium tremens*), with moist tremulous tongue, foul breath, confined bowels, total anorexia, cephalalgia, excited unquiet countenance, general tremors, moist skin, and various delusions: he coughed, it is true, expectorated some muco-epithelial matter, and his breathing was hurried; but these symptoms were thrown into the shade completely by the class indicating a mild seizure of *delirium tremens*. However the cerebral symptoms yielded in a few days; the pectoral grew more severe; and death took place in six weeks, under all the conditions of acute phthisis, the symptoms of which had at first been modified by the habits of inebriety of the individual. The patient, I learned, had previously exhibited symptoms of phthisis, which had remained perfectly quiescent for at least twelve months.

(h) The prostration and delirium of acute phthisis are scarcely marked enough to simulate those of *pyæmia* at the outset; still I have found it satisfactory to be enabled, by the history of the case, to exclude the latter affection from consideration.

(i) *Acute glanders* may in regard of its chest manifestations so closely simulate acute phthisis, that it is fortunate, in respect of diagnosis, the nasal and cutaneous conditions of the former affection exist to mark the distinction between the pair.

1345. *Prognosis*.—The ultimate prognosis of acute phthisis is of necessity almost absolutely fatal,—not so, however, the immediate. Thus, one of the patients just spoken of, seized at the close of April, suddenly improved to so marked an amount in July, that convalescence from the first attack must be admitted to have set in; she walked about the wards, and had scarcely any symptoms. In August another acute attack supervened, which cut her off on the tenth of October. Now it is quite conceivable that under hygienic

* Garrett, U. C. H., Females, vol. vi. p. 145

conditions of very favourable character the second outbreak might have been warded off for a considerable, nay, an indefinite period.

1346. *Treatment*.—The treatment of acute phthisis is far from being well understood,—the rarity with which the disease is diagnosed explains this. Leudet, as matter of experience, lauds the expectant method: better trust to the efforts of nature, than run the risk of doing harm by purely tentative interference. Perhaps he is right.

Still it is painful to look on, a mere spectator. The tendency to pneumonia seems to justify the cautious removal of blood by cupping. Counter-irritation at a certain distance from the thorax will probably be serviceable: large blisters to the chest itself are injurious. Purgation must be avoided, from the danger of exciting the tuberculisng process in the intestines. Diaphoretics and sedatives are advisable; and acetate of lead and digitalis have some claim to trial. The inclination to failure in strength, from the first almost, renders the exhibition of antimony wholly inopportune; mercury seems a more hopeful medicine, and has certainly not yet been fairly tried.

The acute symptoms having once passed away, the management of the disease becomes that of its chronic form.

(B.)—SECONDARY ACUTE CONSUMPTION.

1347. (a) Acute phthisis may suddenly destroy the life of persons labouring under the chronic disease, at a period when the symptoms of the old-standing tuberculation may have fallen into a state of quiescence or even latency. The symptoms of the acute miliary deposition may under these circumstances be very slight; so slight, that I am disposed to think such deposition may be looked on as explaining some cases of "sudden and unexpected death" in the chronic disease.*

1348. (b) Or acute miliary tuberculation may form the terminal phenomenon of various slowly destructive maladies. In the latter remarkable aspect, acute phthisis had not, so far as I am aware, been even glanced at by writers, until the subject was broached in the second edition of this work. Tuberculation may, in this aspect, imitate pneumonia, and bring to a sudden close the career of lingering sufferers.

1349. The following are the most striking illustrations I can refer to.

(a) Two men, of middle age, dying of paraplegia, had myelitis,

* Gilbury, U. C. H., *Malra*.

sharply limited to the dimensions of an oblong, horse-chesnut looking mass developed in the spinal meninges. In one of these cases the tumor had the microscopical constitution of tubercle; * in the other those of low exudation-matter.† In the former instance the patient died with symptoms clearly traceable to the acute tuberculation found in the lungs; in the other instance the tuberculating process remained latent. In both patients the anatomical characters of acute phthisis were perfectly developed.

(b) I have seen death rapidly caused by acute military tuberculation in a man who had for years laboured under attenuated dilatation of the heart and chronic vesicular emphysema. Pulmonary apoplexy and oedema, with intense venous turgescence of the surface, showed the grave amount of cardiac obstruction.‡ This case alone would suffice to prove that "venosity of blood" constitutes no absolute obstacle to the tuberculating process [1281].

(c) Acute tuberculation may, I believe, abruptly destroy life in leucœmia; but as there was no microscopical examination in the case on which I found the statement, I cannot speak with complete surety.§

(d) Similarly, acute pulmonary deposition may close existence in cases of pre-existent tuberculation of unconnected organs. Thus, a man aged 35, in whom the texture of the supra-renal capsules had long been destroyed and replaced by huge masses of crude tubercle, was rapidly struck down by acute phthisis.||

SPECIES II.—CASEOUS INFILTRATION, OR "PNEUMONIC PHTHISIS"

1350. Caseous infiltration or caseous pneumonia represents the various forms of "tuberculous infiltration" of Laennec, gelatiniform, grey and yellow. Such infiltration may occur as an irritative result of the development of the miliary granulation (4 "Tuberculo-pneumonic phthisis" of Addison*), and so assume the guise of a further evolution of this; or it may have an independent existence; or, as long ago pointed out by Louis, it may entail the formation of miliary tubercle within its own area.

1351. Under all three conditions the course of the disease may be acute or chronic; if of acute course, the early likeness is to

* Anson, U. C. H., Males, vol. ix. p. 254.

† Knowles, U. C. H., Males, vol. x. p. 13.

‡ Mr. H., seen with Mr. W. Bailey.

§ Wilkinson, U. C. H., Females, vol. xiii. p. 145 (died and was examined, post-mortem, at her own home).

|| Haslam, U. C. H., Males, vol. xiv. p. 179. This man's supra-renal capsules were converted into huge masses of tubercle; but the skin was free from brooded taint.

* Guy's Hospital Reports, 1845.

asthenic pneumonia, the eventual to rapidly destructive phthisis,—if of chronic course, to ordinary chronic miliary phthisis.

L—ACUTE CANEOUS INFILTRATION.

1352. *Symptoms.*—The local symptoms are those of pneumonia of asthenic type; there is no single distinctive unit among them. The assertion that prune-juice sputa are specially frequent is, if I may trust my experience, a grave error. But the pyrexia is less marked, the temperature less raised, and the respiration less frequent than in sthenic consolidation.

Systemic sympathy (except that signified by general adynamia) is, curiously enough, sometimes less obvious than in active inflammatory disease of the lung. There may be very little delirium. The bowels may be extremely constipated, though, as shown after death, the intestines are ulcerated.* Deficiency of urinary chlorides habitually occurs.

By-and-by, say from the fourteenth to the twentieth day, break-age of the infiltrated tissue sets in; the symptoms then become identical with those of acute tuberculation.

1353. *Physical Signs.*—Whatever these signs be, their original site is basic, or central, as a rule; eventually they travel upwards.

Inspection discloses nothing special; the measured semi-circular width of the affected side, especially if infiltration have occurred on an extensive scale, may be slightly increased; application of the hand may detect some increase in vocal vibration,† and some deficiency of chest motion; but it is impossible to say in what part of the chest this deficiency may be most marked.

The resonance under percussion is more or less impaired,—at first in some limited points, subsequently over the surface pretty generally. Dulness may become extreme at the base; though to the last hour various spots may give resonance not positively abnormal. The quality may be markedly tubular in some places, independently of excavation: with cavity, even on a small scale, amphoric. All will depend on the accidental localisation of the deposit.

The respiration, weak in some points, exaggerated in others, assumes bronchial or even faintly tubular quality over the most densely consolidated parts; but the highly marked sniffling, metallic breathing of hepatised consolidation may be wanting, even

* Hodson, U. C. H., *Males*, vol. i. p. 16.

† Hodson, U. C. H., *Males*, vol. ix. p. 16: vocal fremitus increased in some spots, impaired in others.

where the entire lung is very closely infiltrated with softening tubercle,*—doubtless because the air is never so completely expressed from the vesicles in the latter as in the former case. I have known the breathing, at first distant, high-pitched, as if hissed between the teeth, subsequently fall in pitch considerably.† Bronchial rhonchi, dry and moist, of various sizes and abundance are heard; if the condensation be very dense, the bubbling rhonchi may acquire a ringing character. If excavations form, thin metallic echoing hollow rhonchus may be caught. The characters of the vocal resonance depend on the closeness and extent of consolidation; null, weak or bronchophonic, but not sniffingly so, as in hepatisation, it may be whisperingly pectoriloquous over the site of a small deep-seated excavation with intervening condensed and infiltrated texture.

1354. *Diagnosis*.—(a) It is easy enough to distinguish this form of disease from *acute bronchitis*: the consolidation-signs alone suffice.

(b) I have known such deadness of percussion-sound and such deficiency of respiration and vocal resonance at the base, that were it not for the maintenance of vocal vibration and the graver constitutional aspect of the case, *pleuritic effusion* might be supposed to explain all [1106].

(c) I know of no means by which acute consolidating infiltration, destined to liquify and disintegrate the lung, may be distinguished with surety at the onset from *ordinary sthenic pneumonia*. We may suspect, nay, even divine, on the basis of constitutional pravity; but we cannot prove: events must be waited for. The more true is this, that seemingly sthenic inflammation may exist at first, furnish its own signs in more or less perfection, its rusty sputa, and perverted pulse-respiration ratio, and give place to acute caseation.‡

Acute primary cancerous infiltration of the lung may destroy life in less than four months, and simulate acute caseous solidification: but that disease consolidates the lung less obviously, is attended with signs of tumor about the main bronchus (of the pressure-class and others), often with peculiar hæmoptysis, severe local pain, and diminished width of the side,—while *per contra*, its pyrexia is greatly less marked than that of caseation.

1355. *Treatment*.—The treatment is obviously that of *asthenic pneumonia*. Whether in any instance such management has ever

* Hodson, U. C. H., loc. cit., case fatal in nine weeks.

† Connor, U. C. H., Females, vol. xii. p. 201.

‡ E. g. Hodson, U. C. H., Males, loc. cit.

prevented otherwise imminent disintegration of tissue is of course unproven.

II.—CHRONIC CASEOUS INFILTRATION.

1356. Except in the fact that deposit and breakage take place more particularly at the base and middle height of the lung, there is nothing to distinguish this class of case from ordinary chronic phthisis. In local and general symptoms as in physical signs, the pair are in the present state of knowledge, clinically undistinguishable.

SPECIES III.—TYPHOID DEPOSIT.

1357. The lung-substance, as well as the tracheal and bronchial walls, becomes in certain cases of typhoid fever the seat of non-plastic deposit identical with that which accumulates under the patches of Peyer and in the mesenteric glands. On the other hand, as long since taught by Louis, young persons, convalescing imperfectly from typhoid fever, not unoften fall into "pulmonary consumption" of acutely fatal course.

1358. That death does occur in some cases after typhoid fever, with rapid breaking up of the tissue of the lungs, and many of the symptoms of "consumption," is indubitable. But it has always been a matter of difficulty to explain the connection between typhoid fever and the assumed tuberculisation of the lungs. Louis accepting the latter as proven, and referring it to the prolonged pyrexia of the former, can scarcely be said to have settled the point. Is it possible that unusually abundant deposition of typhoid matter may in these cases be the real groundwork of the rapid destruction of the lungs? The question, beset with difficulties, it is true, requires serious investigation. I have occasionally witnessed most remarkable disappearance of local and general symptoms,—recovery, in truth, complete in a practical sense,—where softening of the lung had rapidly taken place in sequence to typhoid antecedents. The very perfection of constitutional cure in such cases gives additional probability to the notion, that the product eliminated is not genuine tubercle.

SPECIES IV.—GLANDEROUS AND FARINOUS DEPOSIT

1359. Among the more important changes, in acute glanders, farcy, and farcy-glanders, ranks lobular pneumoma, with deposition of specific pus, identical with that contained in the cutaneous

pustules of the one disease, or the suppurating lymphatic glands of the other.

1360. The treatise of Rayer contains an engraving of the secondary pneumonic abscesses which occur in acute glanders.*

1361. In illustration of the farcinous disease, a few prominent particulars of the case of a horse-keeper, aged twenty-five, who came under my notice some years ago, may be given.† Here, in addition to external pustules and phlyctenæ, phlebitis, lymphatic inflammation, and deep-seated collections of pus and discoloured serum in the limbs, without nasal affection, the lungs presented numerous lobular patches of inflammation with softened exudation and pus. No true hepatisation existed; while the non-acceleration of the breathing, slightness of the cough, and absence of pain, almost placed the pneumonic affection in the latent class. The foreign accumulation in the lungs with sero-sanguineous œdema sufficed to raise the weight of the right lung to 27 ounces, of the left to 22 ounces.

SPECIES V.—LEUCŒMIC DEPOSIT.

1362. Nodular deposits in the lungs, composed of extravasated white blood-cells, have been found in some cases of leucœmia. They doubtless increase the dyspœcia, traceable to the specific morbid condition of the blood, though they seem scarcely to exceed a lentil in size [1471].

These nodules may soften, undergo elimination and leave excavations behind them;‡ but their clinical history is as yet very imperfectly defined.

SPECIES VI.—SYPHILITIC DEPOSIT, OR SYPHILOMA.

1363. The lungs hold a well-defined place in the class of visceral sufferers from constitutional syphilis.§

1364. Fibro-plastic material, identical in naked-eye and in microscopical characters, as also in mode of development, with the gummata and exudative infiltrations of tertiary syphilis in the subcutaneous and sub-mucous tissues, the tongue, the liver, and the heart, appears in the lung in the nodular and infiltrated forms. In either form the disease may be the sole morbid condition in the lung.

* De la Morve et du Farcin chez l'Homme, 1837.

† H.B. V. C. H., Males.

‡ Olivier et Ranvier, in Dubell's Reports, vol. ii. p. 28.

§ Rokit. Clinique Iconographique, &c., 1851; Wilson, Guy's Reports, 1863, and Lect. on Syph. 1867; Murchison, Path. Trans. vol. xi; Moxon, Guy's Rep. 1865.

Amyloid and lardaceous degenerations of various viscera are often associated with syphiloma.

(A).—NODULAR DEPOSIT.

1365. These nodules, rounded in shape, yellowish-white in colour, varying in size from a pea to a walnut, originally opaque, dry, hard, almost creaking under the scalpel, eventually soften down and undergo disintegration with elimination, and leave behind them excavations in the lung-tissue. They may form in any part of either organ, but affect a preference for the bases and periphery. In mode of formation they are rather lumpy infiltrations, than true superadded tumors: the textural elements being found within their area. In the softened material there is much similarity to tubercle, but the microscope exhibits only broken up fibro-plastic cells and granular fat.

1366. *Clinical history*.—Several recorded cases show that, when small and unsoftened, these syphilomata, even though they be numerous, give rise to no symptoms; a fact in perfect accordance with what is known of cancerous nodules also [1381]. Even when they have attained a certain size, their discovery has commonly been reserved for post-mortem examination.

As to physical signs there can be none, if the nodules be small, though their number be large: excess of pulmonary resonance would certainly not form a justifiable ground of their diagnosis [1382, c].

If softening and elimination occur, excavation-signs must follow. But these will be less clearly defined, than in tuberculous, caseous or cancerous breakage, in consequence of the deficiency of notable hardening of tissue around the excavated spots. I have not seen any case (nor do I know of any published story of the kind) in which I had clinically followed the excavating process, and found after death nothing but broken-up syphilomata in the lungs.

(B).—INFILTRATED SYPHILITIC DEPOSIT.

1367. There is reason to believe that the diffused form of the disease is notably more common than the circumscribed.

1368. *Anatomical characters*.—As in non-diathetic cirrhosis [1408], fibro-plastic substance or induration-matter infiltrates to a variable extent the intercell-spaces, and the interlobular-spaces, and replaces the actual pulmonary parenchyma. There seems to be nothing distinctive in the characters of the syphilitic variety of the

product; and the connection, between the low quasi-inflammatory process producing it and syphilis, is only to be established by the antecedents of the individual and the coexistence of various positive results of tertiary syphilis. But this is equally true of the indisputable syphilitic formations, lingual, sub-mucous, and sub-cutaneous. The infiltrated form, as well remarked by Dr. Wilks in his very thoughtful Essay, is the less characteristic of the two; but there can be no doubt it is greatly the more important clinically.

1369. *Clinical history.*—Syphilitic infiltration of the lung may, I think, be expected clinically to follow either of two widely different courses;—it may undergo absorption, or it may soften and break up.

1370. (a) The issue in cases of absorption seems exemplified by the following brief narrative. A gentleman, aged about twenty-seven, had chancre and suppurating bubo,—subsequently ulcerated throat and squamous syphilide. Some months later a troublesome cough brought him under my notice; he had had no hæmoptysis; the expectoration, muco-purulent, was destitute of special character; there was no pyrexia; little, if any, positive wasting; the aspect generally was not suggestive of tuberculous or other disintegrating lung-disease.

The left side of the chest had all the physical attributes of health. On the right side high-pitched toneless dulness, not the least wooden in quality, suggestive of soft consolidation, reached from a shade below the clavicle to about the fourth rib, almost joining on with the liver-dulness,—it was not perceptible above the clavicle, nor in the axilla, and was much less marked behind than in front. The respiration, high-pitched but weak, reached the ear unattended with dry or moist rhonchus.

Evidently this consolidation was not tuberculous, nor caseous: its combined unilaterality and extended area stood as a fatal objection to either notion. Cancerous infiltration looked much more probable: for the solidity was at the usual side and occupied the usual site at that side; and the absence of pressure-signs was not incompatible with the existence of that form of the affection. The diagnosis was left undetermined.

The patient went South; improved in general health; shortly after had epileptiform seizures; came home with palpable extra-cranial, and inferrible intra-cranial, nodes, and his lung unchanged. He was put on a course of bichloride of mercury, under which, among other changes, the lung so completely recovered, that after a while not a particle of difference could be detected in the percus-

sion-note on the two sides. Years afterwards I saw this patient in perfect health.

The evidence seems very strong here that softish syphilitic exudation had undergone absorption. True, neither in non-diathetic nor in syphilitic fibroid infiltration has the product been actually *seen* in the lung in the soft state; but Guebler has found the exudation-material soft, even quasi-liquid, in the liver of infants cut off by syphilis.

1371. (*b*) But here is a graver condition of things. Secondary syphilis, cutaneous, pharyngo-laryngeal and anal, has existed in an individual, who is gravely emaciated and enfeebled, who has pyrexia and night-sweats, with cough and more or less expectoration,—though not, as far as I chance to have seen, hæmoptysis. Here the physical signs may prove, in a tempered form, those of non-diathetic cirrhosis, limited in the main to one side, especially the class of signs appertaining to bronchitis [648]. When first seen, I do not know any means by which a case of this type could be with surety distinguished from some form of tuberculous or caseous destruction, or from an unadvanced condition of ordinary cirrhosis. But by-and-by when rapid extinction seems imminent, wasting and prostration being alike carried to extremes, a rally, inexplicable almost on the hypothesis of any one of those three affections, takes place; the patient goes on for a while well, and the diagnosis becomes clearer. Sooner or later he again breaks down,—life seems again in jeopardy, and again is saved.

Now I entertain no doubt that cases of this class have been set down by the older observers as examples of ordinary tuberculous phthisis running exceptionally a remittent or quasi-intermittent course. They are chiefly observed among the dissolute of both sexes; and I suspect they may in some measure supply the real foundation of the opinion that phthisis runs a slower course in habitual drinkers than in sober persons. But only in some measure: for I have observed this slow course in drinkers who were very positively non-syphilitic. Probably, too, the cases of phthisis, “cured with mercury” by our forefathers, were really examples of syphilomatous breakage.

Eventually death takes place without miliary tuberculation or caseation having occurred; other tertiary syphilitic phenomena oftentimes hastening the fatal issue.

1372. *Diagnosis*.—The want of proportion between the general symptoms and the local chest-mischief; the unilaterality of the attendant bronchitis; the slight amount or absence of night per-

spirations, and the syphilitic history, or the actual presence of tertiary changes, are the main guiding elements of diagnosis. But these may be quite insufficient to justify a formal opinion, until time, sufficiently long to display the peculiar course of the disease, has worn away.

1373. *Prognosis.*—The prognosis, though grave, is very greatly less so than in tuberculous disintegration.

1374. *Treatment.*—Slight mercurialisation, and best by the iodide of mercury, is singularly beneficial in some of these cases: probably the more so, the more positive the evidence of syphilomatous tumor of well-marked dimensions. Iodide of potassium, if there be real objections to the use of mercury, forms the most reliable medicine.

Various mercurial and ioduretted remedies may be used with great advantage as inhalations, either with Sturt's instrument or Seigle's spray-inhaler.

A course of the waters of Aix-la-Chapelle proves singularly beneficial to some of those sufferers.

The fitting remedies for all wasting diseases must, of course, be employed as subsidiary aids.

SPECIES VII. CANCER.

1375. Cancer of the lung, though very much less rare than was till recently supposed, is, absolutely speaking, an uncommon affection. Herrick and Popp found these organs cancerous in 6 of 1091 persons who had died of all varieties of disease indiscriminately; and these 6 examples of pulmonary cancer (including secondary and primary) were the contingent furnished by 67 cases of the disease variously located.*

1376. *Anatomical conditions.*—(a) Cancer of the lungs forms in rare instances the solitary local expression of the diathesis. When associated with cancer elsewhere, the groupings of affected parts and organs have proved of every conceivable variety: the lachrymal gland and nares; the abdominal subcutaneous tissue, pancreas and left kidney; the mesenteric glands only; the right testicle, the verumontanum and the liver; may be mentioned as some of the most curious combinations. When thus associated the pulmonary formation is very usually secondary: the lung, so ready to afford a resting-place to cancer-elements travelling from other sites, exhibits but feeble inclination to inoculate distant parts with

* Vide Author's work on Cancer, p. 329

its own disease. And further, *cisceral* contamination, clearly secondary to cancer of the lung, is greatly less common than migration of the disease to the bones or subcutaneous areolar tissue of the chest-wall.* But internal organs do sometimes suffer in sequence to the lung: further on is briefly narrated a case in which encephaloid nodulation of the left lung and of the brain was plainly secondary to similar and extensive infiltration of the right lung [1387].

(b) Cancer exhibits somewhat of a special proclivity to germinate secondarily in the lung, where the testicle has been the primary seat of the disease.

(c) The relative frequency with which the different species of cancer grow in the lungs is shown in the following arrangement of 106 cases, 58 formerly collected by myself, 48 by Aviat.†

Encephaloid	50	Hematoid	1
Scirrhous	16	Fibroplastic	1
Mixed	20	Doubtful	5
Colloid	3		

Colloid and encephaloid have been found in primary association; so too (in a singular case by Verneuil) occupying, secondarily, spots in the lung, pleura and diaphragm, where the same pair of species had primarily sprung up in the mamma.

(d) Secondary cancer implicates both lungs, except in infinitely rare cases. Primary cancer, on the contrary, is habitually unilateral, and affects a well-marked preference for the right organ. Thus, in 29 cases of intrathoracic cancer, where the lungs were either affected *ab initio*, or consecutively to growth in either mediastinum, I found the right lung had suffered alone 19 times; in 4 of the 29 the disease was bilateral. Again, of 31 cases collected by Köhler the right lung supplied 15; the left, 8; both organs, 8.‡

(e) Secondary cancer occurs almost invariably in the nodular form: I have, in an instance or two, seen infiltration where the secondary character could not be doubted. Primary cancer may infiltrate the tissue; or spread from the root of the organ in irregularly tubercous form; or hang in pedunculated masses from the surface of the lung;§ or festoon its free margin with rows of fringed processes.

* Minute subcutaneous and periosteal psiform cancers made their appearance shortly before death, from pulmonary encephaloid, in Jennings (U. C. H., *Fetiales*, vol. xv. p. 64).

† Quoted by Cockle in his elaborate and lucid monograph, *On Intrathoracic Cancer*, 1865.

‡ Cockle, *loc. cit.* p. 51.

§ Case of Dewing, U. C. H., *Males*, vol. v. p. 19.

The weight of a cancerous lung may rise to four, five, or even six pounds. The bulk does not increase *pari passu*: a lung weighing two pounds and upwards, may be smaller than natural,—a fact on which much of the physical diagnosis of the disease hinges.

(f) Cancerous nodules vary in size from a pin's head to a Maltese orange. Spherical or flattened in form, if of any size, they are commonly cupulated on the surface, when seated immediately beneath the pleura. They do not necessarily entail any structural changes in the surrounding texture—certainly at first they simply push it aside; and though, only as matter of the purest exception, are they ever truly encysted, they may, as a rule, be enucleated with ease, because encased in a sort of shell of areolar tissue. In the case of tuberos masses combined with infiltration, the cancerous matter seems to replace, molecule for molecule, the pulmonary texture, in such fashion that the outline of lobules is distinctly preserved. In like manner the bronchi may be metamorphosed into cancerous tubes.*

(g) The intrinsic progress of cancer obeys the same laws in the lung as elsewhere. Fatty conversions and softening commonly start from the centre; elimination and formation of cavities in due time ensue.

(h) The ultimate branches of the pulmonary artery and vein sometimes undergo obliteration through external pressure. The trunk and larger branches of both pulmonary artery and vein, as also the inferior cava, may contain encephaloid substance, or coagulated fibrin. The nerves have not been carefully traced; but from analogy may be presumed to be infiltrated and destroyed, or rendered atrophic by pressure.†

(i) Either a main bronchus or the tubes of secondary order may be obliterated by pressure of a growth on their outside (dilatation on the laryngeal side of the obstruction may then ensue); or the tube may be plugged by the free development within it of cancerous substance, which had first perforated its wall.

(k) The bronchial glands may be perfectly healthy; whether this be the rule or not, I would not venture to affirm: they are sometimes infiltrated with solid stromal, or diffuent creamy, encephaloid.

(l) Sideward detrusion of the œsophagus has been observed; in

* E.g., in Jennings, U. C. H., Females, loc. cit.

† Vide Clin. Lect. on case of Smith, multiple subcutaneous cancers, Med. Times and Gaz., Aug. 1852.

one remarkable case of this kind the obstruction to deglutition was so great that the ingesta accumulated in a pouch above the compressed spot.* Lateral displacement of the heart and trachea may ensue from pressure of an associated tuberculous mass, if this be large: or, in consequence of lessening bulk of the lung during the process of infiltration, the main bronchus and the trachea may be notably, the heart slightly, drawn towards the diseased side.

(m) For a time, even in cases of infiltration, the non-cancerous pulmonary textures may escape anatomical change. Eventually, however, atrophic destruction, œdema, pneumonic consolidation, lobular and interstitial, collapse of lobules, diffuse pulmonary apoplexy,† gangrene, rupture of the pleura with escape of blood and diffuent encephaloid into the serous cavity, pneumothorax, hydrothorax, empyema, are, all of them, effects for which, experience has proved, the clinical observer must be prepared.

(n) Blood infiltration and melanic deposition are common within the area of pulmonary cancers. Fatty metamorphosis of portions of them have frequently been seen; and here, as in other organs (liver, kidney, testicle) the change gives the cancerous substance the appearance of tuberculous deposit for which, I think I have shown it to be probable, it has often been mistaken by the earlier observers of the present century, Bayle among the number.‡ Probably this change must be accepted as evidence of a disposition to retrograde action, and *pro tanto* to intrinsic cure.

1377. *Coexistences*.—Tubercle and cancer, as I long since showed numerically,§ rarely co-exist. There is, however, no absolute constitutional antagonism between the two diseases. We occasionally see growing encephaloid and softening tubercle seated side by side in the same lung.

Gout may co-exist with pulmonary cancer.||

Louis, many years ago, proved that among *chronic* diathetic and specific diseases, phthisis and syphilis alone seemed disposed to entail ulceration of the small intestines among their other systemic evils. The history of pulmonary cancer, as a rule, supports this piece of doctrine: I have met with but one *doubtful* exceptional case.

1378. *Causes*.—(a) The general law, which assigns a vastly

* Van Swieten Comment. in Boerhaave Aphorism, t. ii. 797, p. 650. Ed. 4to. Taur. 1747

† Carswell's framed drawings, U. C. Museum

‡ On Cancer, loc. cit., p. 83.

§ Cyclopaedia of Surgery, vol. i. p. 623. 1840

|| As it did in Jennings' case, already quoted

greater share of cancerous disease to the female than to the male sex, is infringed in the special instance of the lung. Of 102 cases (44 collected by myself, 40 by Aviat, and 18 by Wurderlich *) the proportion supplied by males was 58; by females, 44.

(b) The influence of age is shown in the following table of 136 cases (44 by myself, 35 by Köhler, 39 by Aviat, 18 by Wurderlich):—

1—10	1	41—50	34
11—20	12	51—60	23
21—30	31	61—70	13
31—40	19	71—80	3

The mortality, then, appears to increase pretty steadily up to the fiftieth year, and then decrease. But this is only the absolute mortality. If these numbers could be compared with the amount of population living in each of those decades in the various countries supplying the cases, the mortality would, I doubt not, be found to regularly increase up to the eightieth year,—in fact, obey the law which, I formerly found, regulates general cancerous mortality in England and Wales.†

(c) I have seen a remarkable instance of tendency on the part of the disease to affect persons of the same blood. Two brothers, of closely similar form and general appearance, began to suffer from symptoms and signs, readily traced to pulmonary cancer, when they had about reached their fortieth year. In both the disease began at the root of the right lung; and in both the peculiar red jelly-like expectoration occurred.‡

(d) Is pulmonary cancer infectively communicable through the expired breath? Curiously enough the elder of the two brothers, just referred to (they were inseparable companions), always maintained he had caught the disease of the other, the first attacked, during a protracted tour through Sweden, from sitting opposite to him in a small double-seated carriage, and constantly inhaling his “very unpleasant breath.” No information had been given concerning the nature of the complaint in either his own or his brother’s case.

I think these circumstances reasonably suggestive,—nothing more. The existence of family proclivity to the disease would of course have made the process of infection an easier one, assuming that infectivity ranks at all among the attributes of the disease.

* Quoted by Cockle, p. 68.

† *In Cancer*, op. cit., p. 149.

‡ Cases seen with Mr. A. Tapsen.

A—SECONDARY NODULAR CANCER CLINICALLY CONSIDERED.

1379. Secondary cancerous nodules vary in size, as we have seen, between a pin's head and a Maltese orange.

1380. There is every amount of desirable surety, except that of ocular evidence, that in the pin's head or miliary form, the disease follows an acute course. These minute cancers are perfectly assimilable to the subcutaneous nodules, the enlargement of which can be traced from day to day.

1381. *Symptoms.*—Secondary nodules may be perfectly latent in regard of symptoms. Pain has not occurred within my observation; the breathing may be free, and cough absent. Where the accumulation becomes extensive, either in point of number or size of the nodules, dyspnoea may, however, occur, and even acquire extreme intensity: yet, *per contra*, even under these circumstances the respiration may remain free almost to the last hour. Hence where dyspnoea does exist to any notable amount, it can scarcely be mechanical in mechanism, and is probably reflex from irritation of filaments of the vagus.

1382. *Physical signs.*—These vary with the size, manner of grouping, and relationship of the nodules both to the chest-wall and the larger tubes.

(a) It is almost needless to say that in the miliary form the growths themselves give rise to no perceptible change in the physical condition of the chest.

(b) I know as matter of experience, on the other hand, that some three or four masses, about the size of walnuts, scattered about the infra-clavicular and mammary region, may very sensibly raise the pitch and harden the quality of the percussion-sound, weaken the respiration at the spot, and impress upon it harsh bronchial quality beyond.

(c) Again, where numerous scattered nodules exist in the parenchyma, the general percussion-tone of the chest may be of the exaggerated Type II. [197];—the probable result of the imprisonment of air by nodular pressure on the tubes and consequent pulmonary distension; this I found to be the fact (post-mortem) at the left side of the chest in the case to be by-and-by related [1387, c].

Bronchitis occurs sometimes; but may be totally absent, even where the nodules are sufficiently close and bulky to cause very distinct deficiency of tone and rise in pitch of the percussion-sound. Its abidingness, when present, forms its only distinctive character.

B.—PRIMARY PULMONARY CANCER.

1383. *Physical signs.*—The variation in the signs, according as infiltration, is or is not accompanied with tumor, is perhaps most easily made intelligible by a tabular arrangement, such as the following:—

PHYSICAL SIGNS OF CANCER OF THE LUNG.

- | | |
|---|---|
| (a) <i>Simple cancerous infiltration, or infiltration associated with limited tuberculous formation, the latter especially seated towards the root of the lung.</i> | (b) <i>Cancer of the lung mainly tuberculous, but, it may be, associated with infiltration to a limited extent.</i> |
|---|---|

INSPECTION.

Retraction or depression of the affected side, with more or less marked deepening of the intercostal spaces, which, however, continue to play in respiration—diminished motions of expansion and of elevation; diminished costal motions.

Diseased side expanded generally, but not with uniformity, or bulged inferiorly; intercostal spaces widened, flat, or even slightly fuller than natural; motions, both general and costal, completely abolished; fluctuation imperceptible in intercostal spaces.

APPLICATION OF THE HAND.

Vocal fremitus increased if infiltration slight; diminished or annulled if great, and especially if coupled with tumor non-adherent to the chest-wall; "diminished in intensity; impulse of heart distinctly perceptible over the anterior surface of implicated side in some rare cases; impulse sometimes double.

Surface unnaturally smooth and even; vocal fremitus completely deficient; neither rattle nor peripheral fluctuation; double pulsation sometimes transmitted from the heart.

MENSURATION.

Semicircular measurement natural or diminished; deficient increase of width during inspiration.

Semicircular measurement of the side natural or increased, width of side unaltered by respiration; antero-posterior diameter increased; vertical measurement increased in cases of very extensive formation; distance between the nipple and the median line greater than on the opposite side.

SITUATION OF SURROUNDING PARTS.

Mediastinum may be detruded towards the opposite side; the heart may be similarly pushed laterally or downwards, or it may be drawn to the affected side, the diaphragm is not depressed, and may be drawn notably upwards.

Heart and mediastinum detruded laterally; corresponding division of the diaphragm with the infrajacent viscera more or less depressed.

[*Before softening of the cancerous matter*]

PERCUSSION.

Most common condition that of Type III. — raised patch and hard, wooden, or tubular quality. But true sample dulness may be the prominent character. Sometimes this difference depends on difference in the density of the cancerous structure, sometimes on the relationship of the diseased parts to the trachea and large bronchi. With the increase in size of the mass a tubular note may change to a toneless one. Whatever be the morbid type present, it may extend across the middle line, whether there be, or be not, mediastinal tumor. In the latter case the phenomenon, much less marked than in the former, depends upon "horizontal conduction" [221].

Sound more or less completely and extensively toneless and of short duration, resistance of wall extreme, limits of the morbid resonance not altered by changing the position of the patient.

AUSCULTATION.

Strongly marked diffused blowing respiration, or with the progress of the disease (in consequence of accidental obstruction or obliteration of a chief bronchus) respiration weak or almost suppressed, — retaining, as long as it continues audible, the bronchial or blowing special character. Vocal resonance variable, may be ringing within chest, or travel to ear and cause vibration of cornea, or it may be healthy or null, heart's sounds audible with undue intensity over the affected part.

Diffused or tubular blowing respiration, intensely developed in some cases, though either absent or those of co-existing bronchitis; vocal resonance variable; heart's sounds audible with undue clearness; double blowing murmur in very rare instances accompanying the cardiac pulsation above mentioned if tumor behind heart, simulation of signs of hypertrophy).

[*After softening and elimination of cancerous matter*]

PERCUSSION.

Sound may recover tone somewhat, acquiring at the same time more distinctly the tubular, almost anphoric special character, the resistance of the walls may proportionally diminish.

AUSCULTATION

Cavernous respiration; thin bubbling or metallic cavernous rhonchus.

Cavernous phenomena wanting, if closure of main bronchus by tumor pressure.

It will be readily imagined the groupings of the two classes of signs must vary almost *ad infinitum*. It is important, however, the student should remember that to counterbalance the contracting influence of true infiltration, a very close proximity to the chest-wall, or very large dimensions of the tuberculous mass will be required. In a case of moderate infiltration of the right lung,

though there was superadded mediastinal tumor inclining to the right side, the measurements of the two sides were—

	Right.	Left.
Above mamma	14½	14½
Below	14½	15½

1384. The non-cancerous lung (for the disease is limited, in the great majority of cases, to one organ) gives signs significant of health, of hypertrophy, of emphysema, or of bronchitis.

1385.—*Symptoms.*—(a) *Local.*—It has occurred to me, as far as I remember, to have seen but one case of genuine encephaloid infiltration unattended by pulmonary symptoms: the affection ran a latent course. But here the infiltration was on a very limited scale, and the patient's life abruptly brought to a close by unconnected disease. It seems to me improbable, as matter of reasoning as well as of experience, that extensive infiltration can for any length of time remain unannounced by symptoms. It is true the singular case, narrated further on [1387], seems to show the wisdom of a cautious view on this point; but in that instance it may be held, that the cerebral symptoms held the pulmonary class in abeyance.

In ordinary cases, pain of variable duration, intensity, character, site, extent, and constancy, apparently occurring either in the cancerous lung itself, in the pleura, or in the intercostal nerves, and often attended with cutaneous hyperæsthesia, is a very constant, and sometimes has proved the first, symptom. But pain may from first to last remain a thing unknown to the patient.

If the disease be limited to pure infiltration, the breathing may continue easy, almost to the close of life: but, especially where tuberculous formation co-exists, dyspnoea, continuous or paroxysmal, slight or intensely grave, and in the latter case accompanied with asphyxial tint of skin, constitutes a dominant symptom: orthopnoea may exist for weeks before death. The dyspnoea arises at once from blood-alteration, from direct pressure on, or reflex interference with, the vagus or phrenic nerves, mechanical obstruction of vessels, and encroachment on the lung-substance and tubes.

Cough, an invariable symptom, is, in very rare instances, dry; in the great majority, attended with expectoration. The sputa may be simply catarrhal, or purulent, or bloody. In the latter case, the blood seems thoroughly mixed with serosity, mucus, or muco-pus; and the sputa, commonly opaque, sometimes slightly translucent, are of the colour of red or black currant jelly (and not very unlike those substances) or pink. Encephaloid detritus

has in rare instances been expectorated, of cognisable physical characters; and cancer-cells been occasionally found microscopically, where the naked-eye characters had failed to appear.* The frequency and peculiarities of cancerous hæmoptysis have already [1208] been dwelt upon. Excessive factor of the breath or sputa, with or without obvious local gangrene of the lung, occasionally occurs.

I have never known the voice specifically affected in cases of pure infiltration; if associated with mediastinal tumor or large tuberculous growth in the lung, all varieties of direct and reflex modification may be observed [488].

The decumbency is most frequently diagonal on the back and affected side; sometimes solely on the affected side: not within my experience on the sound side alone; though under the improvement produced by treatment, temporary power of lying on that side may be acquired.

1386. *Pressure signs.*—Infiltrated cancer produces no *centrifugal* pressure signs [483], and the only *centripetal* signs of the kind which it appears, unassisted by tumor, to have positively entailed, are dysphagia and obstructed breathing. Even unilateral œdema fails to appear unless there be tumor. And if the mediastinum and root of the neck be free from tuberculous growth, no difference can be detected in the carotid or radial pulses on the two sides, or in the state of the pupils [487]. If associated with mediastinal tumor, the various pressure-signs of that disease will be more or less prominently present.

1387. (*b*) *General.*—The general symptoms, less grave as a rule, than might reasonably be anticipated, in exceptional cases prove really but slight.

Emaciation, though slow in appearing, once established, occasionally advances with extraordinary rapidity. The loss of flesh may be more sudden than in phthisis.

Pure infiltration gives rise to no special form of systemic dropsy; slight œdema of the lower extremities occurs at the close as in all chronic wasting diseases. There is little disposition to embolic dropsy of the lower limbs. All this becomes, of course, *toto caelo* different, where tumor intervenes.

Even where other organs are cancerous, the skin may to the last fail to exhibit the true cachectic coloration of the disease,—

* Dr Ransom, of Nottingham, tells me he has found the ciliated bronchial epithelium fatty

the asphyxial tint predominating. Sometimes, however, the genuine straw-like or waxy shade appears.

The pyrexia, at first slightly, may eventually become highly marked. Still the temperature, on the whole, rises less than in phthisis, and may actually continue normal to the very last. The pulse too may not exceed 110 to 120 to the close; and a pulse-respiration ratio of 3:1 or 2.5:1 obtain. Night-perspirations sometimes occur copiously; but, on the whole, they do not reach by any means the phthisical average; just as in phthisis, the more profound the sleep, the more profuse the cutaneous flux. Perspiration may be confined to the affected side. On the whole the febrile phenomena are rather exponents of secondary changes than of the cancerous process itself.

The digestive organs may or may not be variously disturbed.

Cerebral symptoms have been noted in rare instances, where the contents of the cranium proved perfectly sound. On the other hand, the following brief narrative shows how singularly deficient cerebral and pulmonary symptoms may prove, though both brain and lung are gravely cancerous:—

J. K. admitted under my care U. C. H., Dec. 21, 1856, a melancholic theomaniac of the sect of "Ranters." About six months previous to admission became subject to fits of memory and fits of rage, sometimes threatening to murder his wife. Took to his bed three weeks since from bodily weakness; has since been dizzy and stupid, but has hardly slept at all. Whilst in the hospital, he lay on his back, with a dull expressionless countenance. He was with difficulty got to answer any question, and then only in a low tone and with extreme slowness; it was noted that he had slight headache, but no pain of any description elsewhere. He had no paralysis, no rigidity of any of the muscles. He lay still in bed, asking for nothing, and passing his motions and urine under him, but, as it seemed, moving from inclination to move. After being in the hospital about a week, he began to refuse his food, which, however, was forced down him, with wine, bark, &c. He gradually became weaker, and died on January 11, 1857, apparently from inanition. No other symptom occurred before death, except that the breathing had become rather laboured *during the last few hours*. He was quite conscious up to the last, and had no paralysis, and no impairment of the senses. He had resisted receiving his medicine shortly before death, endeavouring to push the glass away with his hands, and, after the medicine was got down, his face put on an expression *not* of disgust with the taste. He *had no cough, nor any other symptom directing attention to the chest*. Post mortem the right lung infiltrated, throughout its lower half, with encephaloid cancer; the left lung crowded with nodules of the same, from a pea's head to a pea in size. Brain presented numerous rounded cancerous masses, studded throughout its whole substance, these varied in size from a small pea to a large nut; there were certainly more than twenty of them.—From notes by my clinical assistant, Mr. Hickman.

1388. *Mode of death.*—Life may be brought to a close in a variety of ways in cases of pure cancerous infiltration.

(a) The mechanism may be local. Asphyxia may be induced by accumulating growths and bronchial obstruction; by sudden evacuation of a large softened mass; by gangrenous destruction of the lung; by embolism of the pulmonary artery; by effusion into

the pleural or pericardial sacs (the two brothers already referred to were destroyed thus), and as a very rare possibility, by hæmoptysis, or by sudden discharge of blood into the windpipe.

(b) The mechanism may be reflex, an attack of convulsions closing the scene.

(c) Or the fatal issue may be one of general asthenia, with mal-nutrition, insomnia and failing vital force.

1389. *Duration*.—There is a want of material to settle with any surety the mean length of life after infiltration-symptoms have set in. I found several years ago that a small contingent of cases fixed the mean duration at 13·2 months; the maximum at 27 months; the minimum at 3·5 months. The disease may then clinically, as well as anatomically, run a sufficiently acute course.

1390. *Diagnosis*.—Infiltrated cancer, either purely so, or in association with moderate tubercous growth, can only be confounded with diseases lessening the bulk of the lung, viz.—cirrhosis; chronic pneumonia in its plastic and caseous forms; tubercle; chronic pleurisy with retracted side; collapse of lung. Until the case becomes practically one of intrathoracic tumor, there is no danger of confounding it with any of the dilating class of diseases.

(a) *Cirrhosis*.—The distinctive marks of the two affections will be found with the history of Cirrhosis [1417, c.]

(b) *Chronic pneumonia*.—1. *Plastic*.—Cancer is distinguished from this affection by the notable amount of flattening of the side; by the occasional extension of morbid resonance beyond the median line,—which never, so far as I know, occurs in *chronic pneumonia*; by any sign of centripetal pressure present, as dysphagia or weak respiration from bronchial pressure,—for such never occur in pneumonia; by the progress of the disease, which, stationary in pneumonia, leads to excavation in cancer; by the peculiar jelly-like or cancerous expectoration in the latter affection, and by the much greater severity of its local symptoms.

2. *Caseous*.—The distinctions are clinically identical with those of tubercle.

(c) From *tubercle* cancer differs, *before softening*, by the signs of *extensive* consolidation being unattended with rhonchus; by the unilaterality of the evidences of disease, which, common in cancer, is infinitely rare in tubercle; by any signs of centripetal pressure, as gradual suppression of respiration on the affected side; the jelly-like expectoration; the less severity of the constitutional sym-

ptoms ; the normal or but slightly raised temperature ; and the total absence of the secondary morbid states of phthisis. If the cancer have *softened*, the microscopical characters of that product may be found sometimes in the sputa ; and the unilateral character of the disease will have acquired yet greater diagnostic significance.

(d) From *chronic pleurisy with retraction*, cancer will be distinguished by the less amount of deepening and narrowing of the intercostal spaces ; the greater respiratory play ; the less irregularity of surface ; the greater amount of respiratory sound, especially in the inferior regions ; * the natural position of the shoulder, scapula, and spine ; the absence of friction-sound ; by any centripetal pressure-sign that may be present ; the peculiar expectoration ; by the greater severity of the local symptoms as a whole ; and by the history of the case, indicating in the one instance a disease on the increase, in the other, on the decline.

(e) The distinctive marks between collapse of lung and cirrhosis [1417, 6] will avail in the separation of cancer and collapse.

The existence of external or internal cancer beyond the chest may lend aid towards the solution of any of these diagnostic problems.

I have not met with any case in which pure infiltration, even though, as is the rule, it occupied a site near the main right bronchus, simulated aneurism of the aorta or innominate artery. But the moment real mediastinal growth intervenes, the aspect of affairs changes. Then the diagnosis, may on the one hand be so simple that "he who runs, may read," or on the other, prove utterly impracticable. But of this, more elsewhere.

1391. *Prognosis*.—Not only is the prognosis absolutely fatal, so far as at present known ; but, if the estimate of duration just given be not unsound, a brief span of life only can be promised. I have no evidence that the disease ever undergoes spontaneous suspension of course, much less arrest.

1392. *Treatment*.—No proof exists that arsenic or conium exercise any beneficial influence, where the lung is the seat of cancer. Nor is it likely that any possible change of climate would do real good : I speak, however, without actual experience on the point.

Symptoms must be relieved, as they occur, by ordinary measures. Dyspnoea is best mitigated by dry-cupping and blisters ;

* On the right side, however, the base may give very little respiration in consequence of an enlargement of the liver, which is drawn up by the contracting lung : this was well seen in Jennings' case, frequently referred to.

small local bleedings give temporary relief, but plainly cannot often be repeated. If the patient be severely tried, chloroform may be inhaled in small quantities; when a special tendency to night-dyspnoea exists, a full dose of chloral may, as I have found, relieve as much as, if not more than, in purely dynamic asthma.

Thoracentesis may be performed, if rapid pleural effusion occur. The operation gave signal relief to one of the brothers already spoken of,—distinctly prolonged his life and smoothed the passage to the grave.

(c)—PRIMARY PULMONARY AND MEDIASTINAL CANCER.

1393. Cancer of the lung is more commonly associated with the disease in the mediastinum than solitary and independent. Hence, in actual practice the clinical characters of solidified infiltration of the parenchyma of the lung and of mediastinal tumor are, as a rule, more or less commingled; those of the one or the other predominating, according to the extent and topical relationships of each. To describe all the variations in the signs, contingent on their mode of association, would be an endless labour; the observer must in difficult cases balance carefully the probable relative power of the *contracting* influence of the infiltrating form of the disease, and the *dilating* influence of the tuberculous variety, on the thoracic wall.

I must ask the student interested in the subject of pulmonary cancer to read in connection with this chapter the sections on Pressure Signs [481], and on Mediastinal Tumors [1510].

SPECIES VIII.—ACEPHALOCYSTS.

1394. Acephalocysts, furnishing the habitats of echinococci, may be found as primary developments in the lung, and the sole evidence of the disease; or, they may be secondary growths. In this latter case, as far as I know, the liver has invariably been the organ primarily affected: they have then either been found *in transitu* outwards, through the lung, from a communicating hepatic cyst,—or they have been found isolated, either in the lung-tissue itself, or in the interior of the pulmonary veins.

1395. *Anatomical characters.*—The natural history of the echinococcus, of the acephalocysts it inhabits, and of the mother-cyst is essentially the same in this organ as in their greatly more common seat, the liver. There is this difference, however, that the mother-acephalocyst sometimes lies in direct contact with the

lung-texture; and unlike that of the liver, is rarely surrounded with a thick shell, or cyst-like wall, of pseudo-areolar tissue. The sac rarely attains great size, and commonly contains fluid of the same physical aspect as that of hepatic acephalocysts,—hence probably of the same very low specific gravity, slightly albuminous, and markedly saline, composition. Though occurring in all parts of one lung only, or of both lungs, acephalocysts exhibit a preference for the bases: in one recorded case, the pulmonary veins afforded them a nidus.*

Acephalocysts may be found in the midst of perfectly healthy tissue: this is very rare. Bronchitis, pneumonia, pleurisy, gangrene, perforation of the pleura and pneumothorax, singly or variously combined, have been met with as local effects. A case, related by Lacunee, renders it highly probable that a pulmonary sac may make its way through the diaphragm, and discharge its contents through the intestines. In Andral's case, where the entozoa occupied the pulmonary veins, the right heart underwent dilatation with hypertrophy, probably from the obstruction to the local venous circulation.

Acephalocysts in the lungs may be the sole organic disease existing; or they may be associated with acephalocysts in the liver, mesentery, and spleen. In one certain instance they co-existed with tubercles in the lungs,—in another with cancer of the uterus,—in another with ascarides lumbricoides.

1395.* *Signs and symptoms.*—The clinical aspects of the disease differ so materially when the lung alone is implicated, and when perforation of that organ from a hepatic sac occurs, that they must be separately considered.

(L.) *Acephalocysts limited to the lung, or at least not directly connected with a hepatic sac.*—*Symptoms.*—There may be a total deficiency of subjective symptoms,—the disease, in fact, being *latent*, provided the cyst be of moderate size, and have not irritated the adjacent tissues. In a case of this sort Andral had found exaggerated respiration, inexplicable during life, on the side where the sac existed.

But the rule is, that symptoms, essentially *phthisical* in character, occur. Cough, dyspnoea, more or less severe chest-pain, and inability to lie on one side; expectoration, catarrhal or bloody, followed by that of fragments of their walls, or of perfect acephalocysts of various sizes, giving at length the special character to the disease. The hydatid expectoration generally occurs

* Andral, Clin. Med., éd. 2, t. ii. p. 412.

paroxysmally, and may, on each occasion, be preceded by suffocative dyspnoea and great general anxiety: the quantity of entozoa substance voided at any one time varies from a few microscopical fragments up to a pint and more of unbroken accephalocysts. Expectoration of accephalocysts may continue in such cases through a period of several months: generally serious pulmonary symptoms precede their first, and follow their final, elimination. Besides this, when the naked-eye evidences of the disease may be deficient in the sputa, portions of echinococci,—the characteristic hooklets—may be detected microscopically.*

1396. *General symptoms.*—The pyrexia may be of continued or of paroxysmal hectic type, with copious night sweats; the attendant emaciation may become extreme.

Physical signs.—So long as the sac remains unbroken, the physical signs simply indicate solidification; the quantity of respiration-sound will vary with the existence or absence of pressure on an important bronchus. If breakage take place, and the sac communicate with the bronchi, tubular or amphoric percussion-note, and the whole class of cavernous auscultatory sounds, will ensue on evacuation of the mother-cyst.

1396.* *Diagnosis.*—The diagnosis from tubercular phthisis will in many cases probably prove impossible, unless accephalocysts or echinococci in fragments or whole, be discoverable in the sputa; such discovery, too, will alone distinguish gangrene, produced by this disease, from gangrene of other kinds. The absence of biliary or urinary elements from the sputa will distinguish the case from communicating hepatic sac and chronic pyelitis discharging itself through the bronchi.

1397. *Causes.*—Of twelve cases belonging, the majority certainly, the small minority very probably, to the present category, seven occurred in males, of a mean age thirty-three,—five in females, of a mean age thirty-one. No clue is afforded by past experience to the ætiology of the affection.

1398. *Prognosis.*—The prognosis is far from very unfavourable in this form of the disease. In nine cases here were the results. Three ended fatally; but in one of these tubercles existed, and in another death was not only not caused, but not even accelerated by the hydatids: the issue was doubtful in a fourth: while in the remaining five, perfect recovery took place. In every instance expectoration of accephalocysts had occurred.

1399. (II.) *Accephalocysts entering the lung from the liver, or,*

* First shown, as far as I know, by Dr. Pearson, Edinb. Journal, 1850.

originally pulmonary, communicating secondarily with a hepatic cyst.

1400. *Symptoms.*—In cases of this class more or less obscure hepatic disturbance has been noticed for a variable period before the outbreak of severe symptoms indicating communication with the lung,—intermediate pleurisy sometimes occurring before the pulmonary tissue itself has been involved. The evidences of hepatic disease have been epigastric pain, occasional nausea, and vomiting without obvious cause, failure of appetite, pains about the right infra-axillary and scapular regions, signs of enlargement of the liver, and dingy earthy yellow or actually jaundiced skin, with icteric urine and fæces. But the real nature of the hepatic disease has, in recorded cases, scarcely even been suspected.

When the lung becomes involved, the following very serious symptoms ensue: inability, from pain, to lie on the affected side; jactitation, pinched anxious countenance, and dread of death; jaundice of variable depth of hue; loaded tongue, sickness, vomiting of food and bile, anorexia, thirst, constipated and subsequently diarrhoeal icteric stools; cough of paroxysmal character,—the paroxysms attended with lividity of face, cold extremities, clammy surface, dysphonia, and all the signs of semi-asphyxia, until relief is obtained by copious expectoration of acephalocysts,* more or less deeply bile-tinged, perfect or in detritus, mixed or not with mahogany-coloured foetid fluid, sometimes even with cognizable shreds of sloughed lung; excessively frequent, small unsteady pulse, and fluttering palpitation of the heart; icteric urine; muttering delirium, nocturnal and diurnal. All these symptoms taken together make error in diagnosis impossible.

1401. *Physical signs.*—The physical signs are those of more or less extensive lung-consolidation, followed by those of excavation,—tubular, amphoric or cracked-metal percussion-note, hollow metallic cavernous respiration, pectoriloquous echo and thin metallic ringing rhonchus.

1402. *Terminations.*—An acute seizure of this character may prove fatal within a few days; or the patient may struggle through one or more attacks of subacute pneumonia, continue to expectorate hydatids from time to time for some weeks, and eventually recover. Permanent change of voice remained in one case recorded by Andral. But death has been the common sequel of such

* I have known nearly a hand-basin full of acephalocysts discharged in this way by an adult male, without immediately fatal results. The asphyxial state closely depends on temporary obstruction of main bronchi, and is identical in mechanism with that observed in some cases of plastic bronchitis.

attacks; and the prognosis is greatly more unfavourable than when the lungs alone furnish the hydatids.

1403. *Causes*.—Of nine cases belonging to this class, two occurred in males of the mean age thirty-one at the time of observation; seven in females, whose age averaged thirty.

1404. *Diagnosis*.—The precise nature of the attack can of course only be diagnosticated by careful examination of the matters expectorated. Bile-stained hydatids, whole or in fragments, even microscopical particles, such as the hooklets, settle the question of nature and seat at once,—they exclude simple hepatic abscess, and perforating pyelitis.

1405. *Treatment*.—Of the specific treatment of pulmonary acephalocysts, as of those otherwise localised, little is known. Chloride of sodium and iodide of potassium, presumably deleterious to echinococcal life, should be tried. But admitting the vitality of existing echinococci to be destroyed, the elimination of the acephalocysts remains for the efficiency of cure to be effected,—unless in the defunct state these entozoa cease to act as irritants to the lung. Natural cure of hydatids by accumulation of plaster-like material within the mother-cyst has not been observed, as far as I am aware, in the lung.

Should an external swelling appear, it seems advisable to open it. M. Freteau (Ann. de Montpellier, t. xi.), sixty years ago, opened a sac in the right dorsal region; upwards of four hundred fragments of hydatids were discharged by the wound, and fifty expectorated: the patient, a male, recovered.

GROUP II.—INTERMEDIATE ADVENTITIOUS PRODUCTS.

1406. Between the group just discussed and that of non-disintegrating products, stand some forms of new product, which seem scarcely inclined to break up themselves or to disintegrate the adjoining normal tissue, but which are often associated with formations possessed of these tendencies.

(1.)—CIRRHOSIS, OR INFILTRATION WITH INDURATION-MATTER.*

1407. This well-defined disease, though noticed and partially described by Laennec,† had attracted little or no attention till the publication of Sir D. Corrigan's enquiries.

* "Interstitial chronic inflammation," and "fibroid phthisis," are additional terms by which this disease has been designated.

† *Dis. of Chest*, Forbes' Trans., Amer. edit., p. 123.

1408. *Anatomical characters.* (I.) *Chronic stage*—(a) Cirrhosis of the lung is essentially characterised by the infiltration of the connective tissue between the lobes, lobules, and inter-cell spaces of the parenchyma, and that surrounding the bronchi, with a material of low plastic force. Sometimes obscurely fibroid, sometimes containing pseudo-connective tissue, in the great majority of cases this material possesses the characters of "induration-matter." Induration-matter I define as a substance "of greyish, yellowish, or white colour: opaque; fragile and cheesy in consistence, or firm as fibro-cartilage; of trifling, or of extreme tenacity; rarely crisp, and generally distinctly tough; commonly elastic; in its firmest condition creaking on incision; occurring in the forms of membranous layers, more or less perfect sacs, nodules, patches (plane, puckered, cupulated or convex), points, granules, wart-like bodies, or altogether amorphous: essentially of protein-basis, yet yielding gelatin in a certain proportion, prone to contain fat (granular or cholesteric), and often becoming the seat of saline (ossiform) deposits. Induration-matter is perfectly similar to none of the natural textures. As it hardens, its texture, densely and closely set, often acquires a chondroid appearance without containing a particle of true cartilage; it is imperfectly (or not at all) vascular. Microscopically it is found to be unprovided with prolific cells; nor are the few cells, it may contain, nucleated as a general fact. It is rendered pale by acetic acid."*

(b) The infiltrating process at first extrinsic to, merely compressing and so obliterating the alveolar walls, eventually extends to the actual texture of these.

Limited in area or affecting an entire lung, more commonly the right than the left, I have met with no example, where pure cirrhosis extensively implicated both organs. When the infiltration is on a large scale, the absolute bulk of the lung falls, while the weight rises, each in the inverse ratio of the other.†

(c) Section of the affected part displays a surface whitish, greyish, or white, speckled with black pigment, in colour uniform, glistening, chondroid or fibro-chondroid in aspect, comprising both the interlobular spaces and the lobules, all vestige of pulmonary tissue having, in fully evolved cases, disappeared, both to the naked eye and microscope, under the encroachments of the induration-matter. Even the outline of the lobules baffles detection. On the divided

* *Cyc. of Anat.*, p. 138, art. *Pneum. Adventitious*.

† *Illustrations of Pathology*, vol. ix, p. 141. "If in the cirrhotic lung, somewhat emphysematous at first, greatly reduced in size, weighed 524 grs., that is, probably, two-thirds of its normal weight, the weight of the healthy lung would be about 1000 grs."

surface appear the orifices of much dilated and thickened bronchial tubes,—and of medium-sized blood-vessels likewise enlarged and over-nourished, while the capillary rete has disappeared. The forms of the bronchial dilatations (an unfailing attendant on the disease in its advanced periods) belong to the nodulated and fusiform types. The elasticity and contractile force of the bronchial tubes being destroyed, while unyielding induration-matter lies around, embracing them closely, it is easy to understand why those tubes should gradually dilate under the influence of atmospheric pressure, especially in the retracted and almost fixed condition of the chest-wall.

(d) In the nodular form these dilatations, which sometimes contain a gritty or caseiform material, singularly resemble excavations in the lung-substance, and the distinction can only be made through their serous-looking lining membrane and their manner of connection with the tubes above and below. I have not seen in the few post-mortem examinations I have made in the *pure* disease, any evidence that the actual induration-matter ever softens and breaks up, so as to form cavities *within its proper area*. On the other hand, that excavations should occasionally so form, seems infinitely probable.

Irregular puckerings, from the interstitial contraction of the induration-matter, seam the surface of the lung more or less deeply.

A thick stratum of induration-matter sometimes lies between, and binds together, the costal and pulmonary pleuræ. Vessels of new formation abound within it.

The bronchial glands may be considerably enlarged and infiltrated with the same material.*

The opposite lung, disposed to active congestion, grows hypertrophous.†

Theory would say the heart must enlarge, especially its right compartments; experience proves, that the organ may to the last remain unchanged in bulk. Where cirrhosis and cardiac hypertrophy have been found together, the nexus of cause and effect may consequently be doubted.

1409 (II.) *Acute stage*.—Cirrhosis of the lung, like the analogous condition in the liver is, in point of fact, known anatomically in its chronic stage only. As in the liver, there must in all probability be a period of the disease, when the bulk of the lung

* Clin. Lect., case of Sharman, "Med. Times and Gaz.," Feb. 1856.

† In Sharman the *right* lung being the diseased one, the anterior border of the *left* organ reached, on opening the chest, an inch and a quarter beyond the right edge of the sternum.

ranges above, instead of, as at a later stage, through the contractile force of the induration-matter, falling greatly below, the natural limit. I have, it is true, occasionally seen in persons dying with obscure chest-symptoms, soft, reddish, lymph-like or exudative-material, interstitially arranged; but that this condition was the real possible precursor of a cirrhotic state, I have no evidence to show.

Patches of cirrhosis may often be described on the confines of various morbid products in the lung,—but they are clinically unimportant. An exception, however, must be made for the case of "carbonaceous phthisis;" where, too, real excavations apparently form within the cirrhotic parts and *both* lungs suffer [625].

1410. *Nature and affinities.*—The reality of a true inflammation-process is as contestable in pulmonary as in hepatic cirrhosis; the clinical antecedents in such cases point to atonic, not active, congestion. No evidence has been given that interstitial suppuration in the lung [1158] has any connection with cirrhosis. There is, in my mind, a much broader distinction between true chronic pneumonia and cirrhosis, than the mere fact that, in the former, exudation originates within, in the latter without, the alveoli.

Cirrhosis can scarcely be looked on as a diathetic affection, though sometimes associated with fibroid infiltration of the liver and kidneys; nor does it distinctly antagonize any diathesis. I have found grey granulation and softened cheesy tubercle, too often associated with cirrhosis of clinical importance, to justify me in adhering to an opinion formerly expressed, that these affections are in the main mutually repulsive.

I have seen post-mortem, or diagnosed during life, on what appeared to me convincing evidence, more or less extensive cirrhosis in cases of chronic alcoholism and of tertiary syphilis; but as to the direct connection in each case between the constitutional vice and the cirrhotic state of lung, I am incompetent to pronounce.* Still, in the latter case, I believe in the syphilitic nature of the induration.

1411. *Clinical History.* (I.) *Chronic or advanced stage.*—The clinical aspects of cirrhosis of the lung so closely resemble those of phthisis, that the former has been perpetually mistaken for the latter disease during life.

1412. *Symptoms.* (a) *Local.*—The cough in cirrhosis, especially when the tubes have undergone dilatation, is usually excessively

* That the closeness of dependence of cirrhosis of the liver on sustained alcoholic poisoning has been exaggerated, is matter of certainty. The liver of the cow affords as perfect specimens of cirrhosis as are ever seen in the human species.

wearing,—violent, constant, sometimes convulsively energetic. The expectoration, copious, purulent, of ash-green colour, running into one mass in the vessel, or thin, diffuent, frothy, and of the different forms of sputor elsewhere referred to [592], remains commonly untinged with blood.

Uneasiness, rather than pain, in the chest (unless there be accidental pleurisy to cause acute suffering), and this not necessarily on the cirrhused side, is scarcely complained of except on enquiry. The patient generally lies on the affected side. In several instances where the disease involved the entire lung, no subjective, and but little objective, dyspnoea existed: a clinical fact probably explicable by the enlargement of the unaffected lung.

Hæmoptysis has occasionally been observed: satisfactory proof of the absence of tubercle, though in some such cases wanting, has been furnished in rare instances. Whence comes the blood? From the evidence of one case I think probably from the non-cirrhused lung: to this organ at least bubbling rhonchus was confined during an attack of tolerably severe hæmoptysis. But as I lost sight of the patient immediately, I have no surety the apparently sound lung was not *incipiently* tuberculised.

1413. (*b*) *General*.—The sleep may continue good for years, the nutritive functions maintain fair vigour, and no œdema make its appearance. Hence, as night perspirations are very unusual, and the pyrexia, if any, moderate, a tolerable amount of strength and of flesh may long be retained. Diarrhœa, due to perverted and excessive secretion from, not to ulceration of, the small intestine, may become a grave symptom.

1414. The non-diathetic nature of the disease seems proved by this relatively slight constitutional suffering. I had long under observation an elderly gentleman in whom every local sign had reached the possible limit almost (the retraction of the side in particular was extreme), and who continued able to enjoy hunting and shooting. The post-mortem examination proved the correctness of the diagnosis.

1415. *Physical signs*. (*a*) The eye, tape, and callipers all testify to semi-circular and antero-posterior retraction of the affected side. I have known the right to measure one and a half inches less than the left half of the chest on the level of the fourth interspace in a right-handed man,—signifying a probable reduction of semicircular width amounting to two and a quarter inches [97]. Infra-clavicular and supra-spinous depression exist: the infero-lateral spaces may be very deep.

(b) The measured respiration-play falls sometimes to zero.

(c) The vocal fremitus, increased over the front of the lung, may be even less distinct at the posterior base on the right side (this being the diseased one), than on the left, if there be much induration-matter between the pleural surfaces.

(d) The percussion is of the high-pitched, tubular, quasi-hollow type, with firm wood-like resistance under the finger, both in front and posteriorly. At the top of the sternum this form of percussion-resonance reaches half-way between the edge of the bone on the diseased side and the middle line: that is, assuming the healthy lung to have yet retained its natural bulk. On the other hand, full pulmonary resonance may be traceable by *very gentle* percussion about as far as the nipple on the affected side, where the sound lung had grown massively hypertrophous.

(e) The respiration is high-pitched, bronchial, or hollow, rarely metallic,—dry, or attended with moist rhonchus of various sizes, thin and ringing, or the reverse. The vocal resonance may be either diffused bronchophonic, or pectoriloquous, of both loud and whispered forms.

(f) The contraction of the lung, which seems in this disease to act even more in a sideward and in an antero-posterior, than in a vertical, direction, tends specially to produce displacement of the heart,—best seen if the right lung be affected, when the organ may beat about the right axilla, and the eye and hand may fail to detect any impulse to the left of the sternum.* No cardiac-murmur is necessarily produced by the malposition.

1416. *Course*.—Lasting, as this affection may, for years without materially lowering nutrition, it still paves the way for death by intercurrent events,—more especially by obstinate diarrhoea, or by pneumonia, or bronchitis of the sound and hypertrophous lung. Besides this, it does eventually, unassisted, destroy life in some cases, through the wasting copiousness of the bronchial discharge and general asthenia. And again, miliary tuberculation and caseation may contribute to hurry on the fatal event.

1417. *Diagnosis*.—Chronic cirrhosis of the lung, belonging, as it does, to the group of pulmonary diseases which diminish the bulk and respiratory play of the affected side, and tend to draw contiguous organs towards that side, can be confounded only with other members of the group. These are,—chronic pleurisy with

* Clin. Lect., case of Sharman, U. C. H., "Med. Times." In this case, while the heart's displacement was very great, the vertical height of the right cirrhotic lung nevertheless equalled 7 inches, of the left $9\frac{1}{4}$ inches: but the latter was hypertrophous.

retraction, simple general collapse of the lung, cancerous infiltration, tuberculation, and chronic pneumonia.

(a) *Chronic pleurisy with retraction* alters after a different fashion the shape of the side,—twists the ribs downwards and inwards; draws the shoulder down, curves the spine, and tilts the inferior angle of the scapula outwards: none of these displacements are produced by cirrhosis alone. Physical signs of the hollow class, by percussion and auscultation, are more extensively distributed in this disease than in chronic pleurisy; the bronchial symptoms and the general suffering are of graver character; and the heart occasionally more displaced, than is usual in the chest perverted in shape by the pleural affection.

(b) *Simple collapse* would cause toneless, dull, not wooden or tubular, resonance under percussion; with weak respiration, neither bronchial nor of hollow type. Besides, general collapse is only practically known as a result of pressure by tumor or aneurism on a main bronchus,—and the signs of those affections would be more or less distinctively present.

(c) In *primary cancerous infiltration*, and in cirrhosis of the lung, there are these points in common: one lung only habitually suffers, the right being in both cases that more usually implicated; the retracted ribs are not notably changed in axis; the patient as a rule lies on the diseased side; there are cough, expectoration, and failure of general nutrition, with hypertrophy of the sound lung. But in cancer inward pressure-signs [485] commonly arise from co-existing mediastinal growth; the aspect is more, and may be cancerously, cachectic; there is greatly more lividity of face, and greater subjective and objective dyspnoea; severe thoracic pain frequently exists; hæmoptysis, or sputa infiltrated with blood, so as to resemble red or black-currant jelly, is often present; there may be tumors in other sites; the heart is not so much displaced; * the unnatural percussion-note of the cancerous side extends *across the middle line*, through the influence of associated tumor; the disease is more active, the clinical aspect of affairs points to briefer duration, while the whole condition of the patient betokens graver constitutional mischief.

(d) *Tubercle*, unassisted, never reduces the girth of the side to the degree attained in cirrhosis; tubercle, though proceeding at unequal rates in the two lungs, affects both,—cirrhosis destroys one

* It has occurred to me that the tendency of cancer is rather to draw upwards, of cirrhosis to draw downwards (in fact, on Jennings; *Cancer of Lung*, C. C. H. Females, vol. xv. p. 65) the former consequently plays more on the liver, the latter on the heart.

ing, and leaves the other free to grow in bulk and substance; in cirrhosis there are neither night-sweats, ulcerated bowels, chronic laryngitis, nor epiglottitis, and hæmoptysis is very rare. Unless under the tractive influence of an enormous excavation (which will then, of course, have its special signs), I have never known the heart carried to the right as much by tubercle, as it may be, as it often is, in cirrhosis.

(c) The distinction during life of this state of the lung from *simple chronic pneumonia* is always difficult, sometimes impossible. In cirrhosis of the organ, retraction of the side is, however, greatly more marked than in parenchymatous chronic inflammation; and if there be a considerable amount of flattening, we may be certain that it is not caused by the latter disease alone. The tubular percussion sound, hollow respiration, signs of dilated bronchi, and traction of the heart towards the affected lung (only distinguishable, however, on the right side), met with in cirrhosis, are not observed in simple inflammation.

1418. *Prognosis*.—Though cirrhosis be ultimately incurable, it seems, as already mentioned, to destroy life less by itself, than through its sequences and accidental complications. With care and appropriate treatment, existence may, I know as a fact, be prolonged for a very considerable time, after serious symptoms have set in.

1419. *Treatment*.—Whether the free inunction of iodine locally would promote the absorption of the induration-matter, remains to be determined; I have used it without obvious result. A trial of natural iodurated waters, especially those of Kreuznach and of Woodhall, might also legitimately be made.

But essentially the treatment should be that of chronic bronchitis and pulmonary consumption combined,—the local aids applicable to the former, added to the constitutional management of the latter.

It seems needless to pass seriatim these different remedies in review, as they are enumerated elsewhere. But I wish to mention that the factor and the amount of bronchial flux may be very greatly lessened by carbolic acid inhalations, and the violence of the cough notably controlled by frequent, small doses of chloral.

The bronchial irritation and the copious secretion may be greatly reduced, its factor wholly removed, at least for a time, and the general health singularly invigorated, under the influence of climate. As a rule, climates of "stimulant" character are alone advisable. In one very remarkable case, where the patient him-

self would insist on selecting Madeira,—that arch-type of “relaxing” climates,—the mistaken choice evidently hastened the fatal issue.

1420. (II.) *Acute early stage*.—Our knowledge of the clinical history of early cirrhosis is even a more complete blank than that of its anatomy. The acknowledgment of the fact may possibly direct enquiry in what cannot fail to prove a most interesting field.

(II).—AMYLOID AND LARDACEOUS DEPOSIT.

1421. Lardaceous or bacon-like metamorphosis of tissue, though infinitely less common than in the liver, is occasionally met with in the lung. Containing cholesterol in large quantity, this new product also gives the characteristic amyloid reaction with iodine.

1422. Like lardaceous degeneration of the liver, that of the lung has been found in the subjects of constitutional syphilis. But while the liver is lardaceous and the lung syphilitic, the latter organ may be completely free from the former species of change.

1423. My experience does not enable me to fill the existing void in the clinical history of this form of disease. The symptoms are, in all probability, ill-defined.

GROUP III. ADVENTITIOUS PRODUCTS NON DESTRUCTIVE OF TISSUE

1424. The group of adventitious products, that find a seat in the lung without damaging its tissue, is of little clinical importance, and may be very cursorily dealt with. Here are found Melanic Deposit, Hematoma, Sarcoma, Cystoma, Cartilaginous Tumor, Osteoid and Myeloid, Blood-vessel, and Entophytes.

I.—MELANIC DEPOSIT.

1425. The lung is a favourite seat of true granular melanic pigment, the granules either free or contained within cells. Melanic cells never exhibit any tendency even to cohere, much less to form the basis of a stroma.* There is no difference between the melanic secretion which accumulates in the lungs of the aged, and that which infiltrates certain growths. And, again, there is no special form of morbid stroma to which melanic pigment specially attaches itself in the human subject,†—though more frequent in medullary cancer than in any other growth.

* Cycl. of Anat. and Phys., art. “Products, Adventitious,” p. 116.

† In the human species, the melanic deposit is common to all ages, and is not infrequently met with in the lungs of the young.

1426. The retrograde anatomical changes of phthisis, whether excavation have or have not occurred, are generally accompanied with more or less copious deposition of melanic granules. Hence, abundant melanic impregnation of the phthisical sputum is of favourable augury.

1427. The black matter which infiltrates the lungs of the aged, may have another origin: it may be carbonaceous substance introduced from without, along with atmospheric air,—differing in degree, not in essence, from that found in the “black phthisis” of miners.

II.—HÆMATOMA.

1428. Hæmatoma, or tumor composed of fibrin, coloured or not, and arising from past hæmorrhage, occasionally occurs in the lung as the final issue of nodular apoplexy,—or as the persistent condition of coagulated blood in a tuberculous excavation.*

Clinically, hæmatoma in the lung is without importance.

III.—SARCOMA OR FIBROID.

1429. Sarcoma, or fibroid tumor, ranks among the rarer pulmonary formations. Nodular masses, passing for cancer to the naked eye, are sometimes thus composed. They have little disposition to intrinsic softening, rarely excite irritation in the surrounding tissues, and consequently produce symptoms on the mechanical principle almost solely.

1430. Such tumors are occasionally formed secondarily in the lungs, in connection with recurring fibroid of the uterus. In some recorded cases, again, they were in all probability syphilitic.

1431. Their local clinical history is identical with that of scattered cancerous unsoftened nodules.

IV.—CYSTOMA.

1432. I have never seen a simple serous cyst within the lung. Laennec's case, often referred to as proving their occurrence, was in infinite probability, according to his own admission, acephalocystic.

1433. A case narrated by Mohr,† in which several cysts of various sizes were found in the left lung, containing (exactly as in pilous cysts of the ovary) free tufts of hair, and hairs attached to the lining membrane of the cyst by well-formed bulbs, stands so far without a parallel.

* U. C. Museum, No. 2213.

† Berliner, Med. Zeitung, 1839.

V.—CARTILAGINOUS TUMORS.

1434. The growth of true cartilage in the lung must be an infinitely rare phenomenon. I am acquainted with but one case of the sort,—that recorded by Sir J. Paget.*

A man, castrated in January, 1855, for a cartilaginous growth in a testis and its lymphatics, died suddenly three months later. The sole symptom, connected with the chest, appears to have been breathlessness, as that of a man "panting after rapid running." Diminished percussion-resonance existed below the clavicles and at the posterior bases; the respiration, bronchial below the clavicles, was mingled with loose crepitation inferiorly.

The weight of the lungs had risen to 11½ pounds from the growth within them of nodular masses of true hyaline cartilage, varying in diameter from less than a line to an inch and a half, scattered irregularly but pretty equally through all parts of both lungs, and embedded in healthy lung-substance, from which they were easily enucleated.

1435. In all clinical respects these tumors were accurately assimilable to secondary cancerous nodules; the effects of both are purely mechanical.

VI.—OSTEOID.

1436. A remarkable example of this rare form of disease occurred some time since in Mr. Quain's practice at University College Hospital. The specimen may be seen in the Museum (No. 4181).

VII.—MYELOID.

1437. A tumor in the lung, secondary to recurring extirpated fibro-plastic tumor, was found by Mr. M. Henry, to contain myeloid cells. No symptoms appear to have announced its presence.†

VIII.—BLOOD-VESSEL.

1438. The adventitious production of blood-vessels in the lung has not yet acquired sufficient practical significance to justify further consideration than that already [1229] incidentally given it.

IX.—ENTOPHYTES.

1439. Some while since, Dr. Hughes Bennett figured an entophyte, allied in appearance to the *Penicillium glaucum* of Link,

* Med. Chir. Trans., vol. xxxviii p. 247.

† Path. Trans., vol. ix. p. 367.

and found on the walls of tuberculous cavities : the jointed tubes of the entophyte had been expectorated two days, at least, before death.

1440. Virchow found an abundant crop of *Sarcinæ Goodsirii* in a gangrenous portion of lung : they must have grown where found. More recently, Zenker gave the particulars of a case where, though found in the lungs, the *sarcinæ* might, as a bare possibility, have made their way into the trachea before death from vomited matters, containing the entophyte in abundance. The discovery has no practical significance at the present day.

SECTION IX.—DISEASES OF COMPOSITE CHARACTER.

1441. Dyspnoea, one of the most common of the mere symptoms of intra-thoracic diseases of all kinds, acquires under certain circumstances (*without ever losing in strict pathology its purely symptomatic character*) such clinical peculiarities and such gravity as to assume the importance of a substantive disease. Dyspnoea of this significance, known as ASTHMA, is more or less paroxysmal in character, and is immediately dependent on perverted innervation of the *bronchial tubes*.

I give bronchial asthma a place apart from simple neurotic diseases [931], because there is always some element, beyond the mere local neurosis, concerned in generating the dyspnoea.

1442. For convenience' sake the peculiar dyspnoea, dependent on morbid states of the blood (*hæmic asthma* or dyspnoea), may be treated of in the form of appendage.

BRONCHIAL ASTHMA.

1443. Bronchial asthma, the result, 'as an almost invariable rule, of a *plus* state of contractility of the muscular fibres of the tubes, may probably in some cases depend on a *minus* state of that contractility;—in the former case the neurosis is *spasmodic* in its mode of action, in the latter *paralytic*.

(1.)—SPASMODIC BRONCHIAL ASTHMA.

1444. *Nature and Mechanism.* By spasmodic asthma is clinically understood paroxysmal dyspnoea, immediately dependent on more or less extensive obstruction of the smaller bronchi, itself caused by tonic contraction of the circular fibres. The immediate cause of this contraction is, in turn, under all circumstances, perverted innervation, affecting the trunk or branches of the vagi or sympathetic nerves. And lastly, this perversion of nervous influ-

ence may arise independently of, or on the other hand in direct connection with, anatomical change in the bronchi or parenchyma. Spasmodic asthma is, in other words, a *primary* or a *secondary neurosis* of the tubes.

1445. When a *primary neurosis*, the paroxysms may be of direct or reflex mechanism: direct, when dependent on centric excitation in the medulla oblongata, or irritation of the trunks of the vagi or sympathetic nerves; reflex, where sequential to œsophageal, gastric or intestinal disturbance,* cutaneous impressions or irritations, uterine or ovarian irritation, spinal irritability, intercostal neuralgia, hepatic congestion, hepatalgia and pure hysteria.

1446. When a *secondary neurosis*, the paroxysms are excited through the reflex irritant influence of bronchitis or emphysema. First, such bronchitis is chronic, commonly sub-acute, and in no wise specially characterised anatomically: and as multitudes of similar cases of chronic alteration of the tubes exist unattended with asthma, there is evidently something special in the diathesis of those who suffer. In these associated cases the patient may earliest have been the subject of pure spasm, and eventually become bronchitic; or bronchitis may have led the way, and by degrees have generated the nervous irritability. Secondly, the connection of emphysema with spasmodic seizures is certainly sometimes, possibly always, established through the medium of intervening irritative or passive congestion of the tubes.

1447. These varieties of mechanism may be rendered more readily intelligible by being exhibited in the following tabular form:—

Immediate excitant of fit — perverted innervation of vagus [and sympathetic].	A.—No local anatomical change (Primary neurosis)	Direct . . .	Irritation of vagus trunks or of sympathetic.
		Centric . . .	
		Reflex (through medulla oblongata)	Irritation of spinal and visceral nerves.
	B. Local anatomical change exists (Secondary neurosis)	Reflex irritation (probably through pulmonary ganglion)	Bronchitis. Foreign bodies in tubes. Emphysema.

* In all cases of asthma where irritation of the terminal filaments of a distant nerve is the cause of the seizure, special predisposition must be admitted without this, asthma will not occur. Thus in the case of a young female with tetanic spasms so severe, that in one of them the neck of the femur snapped as two, the attacks were completely cured by mechanical removal of acylula from the rectum; there was no semblance of disturbed breathing. On the other hand, in predisposed persons, I have known ordinary constipation of a few days duration suffice to bring on a severe paroxysm.

1448. *Class A.*—In the class of *primary neuroses* it must be remembered that although theoretically, and sometimes as matter of observation, we are called on to admit the direct and centric mechanisms, examples of these at the bed-side are excessively rare,—the bulk of cases being of reflex origin.

Emotional excitement, fear especially, supplies occasional examples of centric origin.* Thus I knew a patient who trusted, as for his very life, to cigarettes of belladonna and stramonium chips; one day at a distance from home he suddenly found his little supply missing from the wonted pocket,—instantly he was seized with a violent paroxysm. Again, sexual excitement will in some persons induce a fit; though, singularly enough, I have known an old asthmatic sufferer, who declared he could ward off an imminent paroxysm by coitus “in the nick of time.”

In reflex cases belonging to this class, any sudden impression upon any portion of the vast nerve-tract—spinal and visceral—which plays the habitual part of first link in the chain of a paroxysm, will, or may, produce a fit.

1449. *Class B.*—Where the disease is a neurosis, secondary to bronchitis and emphysema, something intervenes to, as it were, start the paroxysm: the inhalation of air irritant from its chemical or physical composition, from its odour, its temperature, its barometric weight, its moisture or dryness, &c.

A foreign body in the tubes will produce reflex spasm by the same mechanism as bronchitic irritation: of this truth, a most remarkable illustration, occurring in his own person, has been given by Dr. Nooth.†

1450. Now it is true of both classes that no one form of excitation is uniformly productive of fit in all people: the very reverse,—one person will with perfect impunity expose himself to an influence, which will induce a grave seizure in another. Nor will the same cause invariably produce an attack in any given individual,—though well-defined exceptions to this rule from time to time present themselves.

1451. Any mechanical difficulty in the pulmonary circulation, such as arises from distended stomach and bowels pushing up the diaphragm and encroaching on the chest, facilitates the action of more direct influences.

1451.* *Mode of seizure.*—*Premonition.* (a) It is deducible from

* Some observers, like Todd, insisting on the peculiar sensation in the chest, sented presumably in the vagi nerves, that initiates the fit, teach that all true *asthmatic* *asthma* is centric in origin.

† *Trans. of Soc. for Improvement of Med. Knowledge*, vol. iii.

statements already made, that warning of a coming fit may be absolutely deficient,—the seizure may be instantaneous and unheralded.

(b) Or there may be vague disturbances (cerebral, chylopoietic, uterine, renal, &c.) for a greater or less number of days or hours, which tell the experienced sufferer of a coming attack.

(c) Or, thirdly, there may be a very brief period of premonition,—a few moments or a few minutes. Phenomena of the same type, as the *aura* in epilepsy, or in angina pectoris,—nervous paræsthesiæ, migrating centripetally from various parts of the frame, may then sound a brief note of alarm.

In all three conditions (a, b, c) a sensation of oppression and discomfort in the chest (whether from an actual commencement of spasm, or from mere paræsthesia of the vagus, it is difficult to say), may constitute the initiatory element of the actual fit.

As in all diseases where the excito-motory system plays an important part, seizures frequently take place during sleep.*

1452. *Symptoms.* I. *Of the Paroxysm.*—And it is then—when a placid dreamless, or a disturbed dreaming, sleep is suddenly interrupted—the symptoms are the most strikingly defined. The patient starts from slumber with a feeling of suffocation or constriction about the chest. The efforts at *inspiration*, convulsively violent, and painfully ineffective, are accompanied, in the purely dynamic form of the disease, with sinking of the epigastrium, falling in of the lower part of the sternum, and elevation of the diaphragm,—evidently from the diminished mass of air in, and consequent collapse of the *lower parts* of, the lungs. The *expiration* is very much prolonged, but unaccompanied with notable anguish. Both acts are attended with wheezing audible at a distance.

Every muscle directly or indirectly concerned in aiding thoracic play is brought into requisition. Various postures are assumed to facilitate the attempt at changing the air within the chest,—the patient stands erect, with the head thrown backwards, seizing some solid object to give greater vigour to his efforts,—or leans the head forwards between the hands, or places himself on his knees and elbows, or rushes to an open window, and gasps wildly for air. The eyes are prominent, staring, watery and suffused, —

* Still, it must be confessed, there is not the great predominance of nocturnal seizures which might lead in Marshall Hall would lead us to expect. The same is true of pertussis, as also of the much graver disease epilepsy, where, according to the elaborate inquiries of Leuret, cases of attack, limited to the day and to the night respectively, are of precisely equal frequency; while Herpin actually found twice as many seizures by day as by night.

the face flushed, livid or pale,—the nostrils dilated,—the look anxious and imploring. The temperature of the general surface falls, while that of the chest may actually rise; clammy, sometimes copious, perspiration breaks out over the head and face, or on various parts of the surface.

If there be extensive pre-existing emphysema, the effects of the fit on the amount of air within the lungs are different. The stagnant volume [122] gradually increases,—the chest-wall undergoing proportional dilatation. This accumulation evidently arises from the natural elasticity of the lungs having been previously destroyed by the emphysema, so that expiratory collapse has become an impossibility. In these cases of association with emphysema it is, that the extreme perversion of the ratio of inspiration to expiration is observed: instead of 3 : 1, 1 : 4 may become the proportion.

The pulse, small and feeble, sometimes grows distinctly irregular, though the patient be free from heart-disease, and there be no actual palpitation at the time.

The urine, pale and abundant during, and occasionally just prior to, the paroxysm, becomes scanty, high-coloured and loaded with lithates at the close: in some persons, however, free watery diuresis continues for twelve hours and upwards after the cessation of the fit.

From a careful hourly analysis by Sidney Ringer* of the urine some hours before, during, and a few hours after, the fit, it appears, a considerable fall in the normal amount of urea and chloride of sodium occurs immediately after the fit: this points to arrest of formation or of elimination.

Although the outward indications, that usually accompany venous congestion of the brain, especially loading of the capillaries and venous radicles of the face and scalp, invariably become more or less marked in the paroxysm, the cerebral symptoms are as a rule slight,—headache, vertigo, tinnitus aurium, photopsia, and some temporary disturbances of vision, comprising all that is observed. Convulsions do not occur, within my experience, even in the worst specimens of pure asthmatic paroxysm,—not even where ecchymosis of the conjunctivæ has formed on so extensive a scale, that a fortnight has been required to remove all trace of discoloration.

1453. *Physical signs.*—The physical signs are by negation significant and important: they prove the absence *in the pure disease* of organic affections of the lungs, heart, and great vessels.

* quoted by Parker on Urine, p. 319.

The form and movements of the chest present two typical varieties.

(a) In simple dynamic asthma there is much laboured and jerking elevation-movement of the thorax,—little or no true inspiratory expansion: retraction, on the contrary, of the anterior base may attend inspiration, while expiration, removing the abnormal retraction, may be said *pro tanto* to expand the walls. The gradual evacuation of the supplementary, and in some measure even of the residual air [122], which takes place in both lungs during the paroxysm, slightly impairs the resonance under percussion.*

(b) If emphysema be co-existent, the asthmatic fit is no longer purely dynamic, and then the chest may gradually dilate at the base as at other parts,—and any respiratory change in girth cease to be perceptible.

In both these varieties true inspiratory sound may be almost completely deficient, sibilant or sonorous rhonchus (probably generated at the constricted points of the bronchial tubes) taking its place,—and holding the same relationship to the spasm of asthma, that the crowing inspiration does to that of laryngismus stridulus, and pertussis. In true asthma, be it ever so severe, the spasm never implicates the glottis.

Long ago Laennec stated that if a patient in the actual fit be induced to speak, without drawing breath, as long as he possibly can, so as to exhaust the chest as completely as possible, the next two or three quiet inspirations produce well-marked and very natural respiration-sound: obviously the tidal air advances deeply into the tubes, and under these special circumstances may be supposed to reach even the vesicles: at all events a fall back of the residual air occurs. This can only depend on temporary relaxation of spasm: but why the process described should effect such relaxation, is not so clear.† However this may be, bronchial dry rhonchi (if there be no bronchitis present) will then, for the moment, disappear, in the same manner, though less perfectly, than they do under the influence of chloroform: an incidental proof of the occasional purely spasmodic mechanism of those rhonchi [316].

1454. *Duration of the Fit.*—A paroxysm may last some ten or fifteen minutes, or be protracted to twelve or twenty-four hours, or

* This I repeatedly ascertained in a girl, named Harmer, a patient both of the Consumption and U. C. Hospitals; but, on the whole, this sign is rarely to be established.

† As to the occasional—limited truth of Laennec's statement I entertain no shadow of doubt. The experiment, however, I know not why, does not invariably succeed; but I have difficulty in understanding how Dr. Robert (on Asthma, p. 55, 1860) can have always found it fail.

even upwards: in these severer cases there is some slight remission, sometimes even an intermission, in the symptoms, from time to time before the final close. The fit may terminate by expectoration or not (humid and dry varieties), leaving, on its cessation, a sensation of more or less intense fatigue and prostration.

1455. II. *Of the Intervals.*—Where the disease is purely neurotic, the patient, during the intervals between the seizures, may enjoy very perfect health, as far as the lungs and breathing are concerned. Where, on the other hand, chronic bronchitis, or emphysema exist, the symptoms of these states are more or less obscurely, their physical signs very plainly, to be discovered. The general aspect, the perverted outline of the chest and shoulders, the habitual attitude and gait of such sufferers, have already been described [990]. Subjectively, however, even in these cases, the intervals may be passed by the patient in comfort and unconsciousness of ailment; it is not uncommon to hear habitual asthmatics boast of their perfect breath, at a time when wheezing is audible at a distance, and all the physical signs of emphysema and chronic bronchitis exist in perfection. Habit, the great physiological modifier, gradually reconciles the system to a minimum supply of oxygen.*

Repetition of asthmatic fits tends to induce marked permanent cyanæmia, and may lead to dilatation of the right heart, and insufficiency, without structural change, of the tricuspid valve; but this latter effect is very rare, unless there be emphysema, as a permanent malady.

1456. *Causes.*—The mechanism and immediate excitants of a fit have been considered; what are the predisposing conditions, or more usual antecedents, of the disease?

(a) Spasmodic asthma is very certainly transmissible from parent to child, and affects collateral relatives. I have also known it (like phthisis and glycohemina) affect three or four brothers and sisters, whose progenitors to two removes had certainly been free from the complaint.

(b) Trustworthy returns on a large scale, showing the influence of age, are yet wanting. The deaths registered in this country, under the head "asthma," at twenty-four periods of life,† include a vast number of cases where pulmonary and cardiac disease

* Hugot Arnott, it is said, was one day, while putting with asthma, looking out of his window, and was almost sufficed by the noise of a fellow with stentorian voice eating oysters. "The extravagant rasped!" said Hugot, "he has wasted in two seconds as much breath as would have served me for a month."

† Tenth Annual Report, p. 290

coexisted. It is safer to limit ourselves to the assertion that true spasmodic asthma is a disease essentially of middle and advanced life,—though there is no age at which it may not occur, while it is not very uncommon in childhood, and is known even in earliest infancy.*

(c) Asthma, both pure and linked to emphysema, is greatly more common in males than females.

(d) Climatic and atmospheric conditions are inexplicably conflicting in their influence, and obviously acknowledge the control of idiosyncrasy. In the mass of men the air of towns is held to be unfavourable, as compared with that of the open country: indeed, in the Registrar's returns, "asthma" stands at the head of the list of diseases relatively more fatal in urban than in rural districts. But I believe this to be an error on the ground just mentioned,—and that, as matter of fact, country air is just as promotive of the disease as town air. In truth it would almost seem as if many individuals had their own quality of atmosphere which, and which alone, is with them *asthma-generating*.

(e) No evidence exists to prove that fits are promoted by the so-called "below-par" state of health: I have met with more than one patient, who always dreaded an attack the most, when most particularly well.

(f) In some persons the occurrence of a fit at a given time becomes a habit; the fit is looked for, and (just as in the case of ague) as surely comes. Regular periodicity is occasionally observed.

(g) I know of no diathetic disease which promotes the occurrence of true asthma: in assigning such disposition to "albuminuria," Romberg appears to me to have confounded hæmic dyspnoea (1467) with spasmodic asthma. No positive proof exists, that even the gouty diathesis generates the complaint.

(h) Hysteria and epilepsy, which may have a specifically modified breathing of their own, have no tendency to induce, or to alternate with, spasmodic asthma.

(i) No organ, so frequently as the stomach, furnishes the first link in the reflex chain ending in a fit.

1457. *Course*.—Genuine asthma occasionally disappears spontaneously: I have met with several instances among children and young persons; but, generally speaking at least, some other evil takes its place. The worst example of wasting azoturia I ever saw,

* Dr. Salter's table (*Op. cit.* p. 113) gives a very large quota to the first decade of life; but the great proportional number living in any population at that period must not be forgotten.

originated shortly after the total cessation of asthmatic fits, to which the patient had been subject for years. On the other hand, I have known a very severe form of the complaint disappear *after the fortieth year* (a very rare occurrence) without sequential evil of any kind.

Asthma is essentially a recurring affection,—that one paroxysm has happened is a reason why others should follow, independently of a repetition of the original excitant, at least in its full intensity.* Probably one fit of spasm permanently modifies bronchial muscular irritability. But that such modification is not indelibly impressed on the fibre follows from what has been stated in the last paragraph. Cases are indeed recorded in which, it is alleged, a fit of asthma has never been repeated: the exciting cause, if the observations were correct, must have been at once powerful, peculiar, and rare.

The frequency and the character of the seizures may change as time wears on: at first rare and severe, they may eventually grow more frequent and milder,—just the kind of modification often observed in epilepsy.

1458. *Duration*.—Asthma may last any number of years: in a patient now under observation, aged sixty, the first attack occurred in the fifteenth year,—and this is by no means an extreme case.

1459. *Antagonisms*.—The occurrence of certain acute specific and diathetic diseases occasionally frees the patient from asthma, either permanently, or for a variable time: I have known this release ensue after erysipelas of the face and scalp, after variola among the former, and after purpura among the latter, affections. The influences, protective and curative, exercised by local tuberculation, have already been spoken of.

1460. *Diagnosis*.—The essential points are to exclude, by means of the absence of their special signs, all pulmonary statical diseases, especially bronchitis and emphysema, and affections of the heart. The special characteristics of hæmic dyspnoea are easily to be substantiated [1469].

1461. *Prognosis*.—Spasmodic asthma not only does not directly destroy, but is compatible with remarkable prolongation of, life: the popular adage likens the possession of the disease to a “lease of a long life.” The blood-state in asthma is, probably, unfavourable in the main to the occurrence of, and *pro tanto* saves the patient from, various grave diathetic diseases; while the habitual

* On the general question, vide Lectures on Influence of State of Health on Disease, *Lancet*, vol. i., 1871.

caution, the patient is forced to observe hygienically, saves him from acute inflammatory disorders. The Registrar-General's large annual return of so-called "asthmatic" deaths is, I believe, explicable in the manner already suggested.

The younger the patient, the more probable is it he may completely recover. It is scarcely necessary to add that the existence and the amount of any organic affection seriously affect the prognosis.

1462. *Treatment*.—In managing an asthmatic sufferer's case we are called upon:—(a) To shorten the duration and lessen the anguish of the actual fit; (b) to avert impending fits; (c) to modify the diathesis, so as to lessen the frequency of recurrences.

1463. (a) During the seizure our object must be at once to relax spasm, and to deaden the consciousness of suffering.

In a first, or in an early, fit, if there be great congestion, bleeding has been held to be advisable; in the case of habitual seizures, it is unquestionably altogether inadmissible.

Nauseating expectorants, ipecacuanha, lobelia, tobacco, squill, act usefully, especially when the habitual disposition is to relief by bronchorrhoea. Actual emesis by ipecacuanha, tartarized antimony, or sulphate of zinc will often, especially in childhood and early youth, cut short a fit very perceptibly.

Antispasmodics, sulphuric, and chloric æthers, assafoetida, and musk, mitigate the intensity of the paroxysm.

And so likewise do numerous narcotics,—stramonium, datura tatula, the cigarettes d'Espic, cannabis Indica, belladonna, and various preparations of opium: of these opium, with its alkaloids, is the *facile princeps*. Subcutaneous injection of morphia is justifiable in an extreme case, with habitually prolonged fits; instead of the induced sleep, making matters worse, as Marshall Hall's teaching would lead us to expect, it at once relaxes the spasm and leaves the breathing free. The hydrate of chloral, tried in a few instances, seems more uncertain in its effect; forty grains will, however, sometimes put an abrupt stop to the attack. Inhalation of the fumes of burning paper, saturated with nitre, sometimes shortens, sometimes charms away, a paroxysm; true, it oftener fails: but I have known old sufferers from asthma confide implicitly in it, to the exclusion of other remedies,—as others have their special affection for cigars of stramonium and belladonna,—yet others for coffee. The paper should be burned on a plate, under covering of some sort thrown over the head, to secure its full influence. It sometimes acts by promoting bronchial flax;

occasionally the rapid relaxation of spasm is the sole effect: it succeeds best in *severe* cases. It has been combined with datura tatula, and in this form sometimes succeeds, when in the simple state it had failed.

Artificial reflex excitations, such as that of ammonia to the nostrils;—the cold-water-dash over the shoulders, draughts of cold water, swallowed while the feet are immersed in a mustard foot-bath,—are all agencies that occasionally shorten the paroxysm.

The effects of the electro-galvanic current, directed from the nape of the neck to the epigastrium, vary. Sometimes immediate mitigation of the suffering (not, as far as I have seen, actual relaxation of spasm) ensues; sometimes on the contrary aggravation of the dyspnoea so distinctly follows, that the patient cries aloud to the operator to discontinue. These varying results used to be explained either by the supposed idiosyncrasy of individuals, or by presumed association variously of spasm and of paralysis of the bronchial fibres. But recent discoveries in physiology concerning the so-called "inhibiting system of nerves," show that another explanation may be looked for,—that the very same nerve, stimulated by the very same agency, say, electricity, will, according to the intensity of this, exalt or depress function in parts to which it is distributed. While gentle stimulation excites, strong stimulation may arrest, muscular action.* The use of galvanism is in truth a double-edged sword.

Inhalation of chloroform, commenced after the invasion of the fit, and pushed to incipient narcotism, varies in its effects. I have seen three kinds of result: total relaxation of the spasm during the continuance of insensibility, with immediate return of dyspnoea on restoration of consciousness,—gradual return of the difficult breathing, after consciousness is restored,—and either total arrest, or at least mitigation, of the paroxysm for the time being. The last effect is the rarest of the three; but, on the other hand, the temporary relief afforded by chloroform is sometimes more complete and more rapid than that effected by any other agent.

1464. (b) An impending fit may be averted by various of the remedies just enumerated, among the rest a full hypnotic dose of

* Pfäffer, the discoverer of the phenomenon of nervous inhibition, affiliated it to a supposed special set of nerve fibres, but the ingenious experiments of Mr. Joseph Lister (Proceedings of Roy. Society, 1858) make it greatly more probable that, as stated above, the same fibres *excite or inhibit* according to the amount of the stimulus they convey, that there is an *inhibiting function*, though not an *inhibiting system*, of nerves. Similarly Kelliker (Med. Times, Sept. 1859) has found that strychnia paralyzes the motor nerves of the voluntary muscles by exciting them to too energetic action.

chloral. Stimulants, such as *café noir*, the strongest that can be made, and brandy, are much more useful in this way than as shorteners of the actual fit. Mental or emotional [1448] excitement will sometimes save the patient. Heating the body generally to as high a degree, as can be borne, is trusted to by some sufferers. Small quantities of chloroform, inhaled when the sensations, precursory to a fit, are felt, sometimes effectually ward this off; and there is reason to believe that, in some cases at least, the repeated use of chloroform after this plan, may eventually break the paroxysmal habit altogether: * this effect can, however, only be hoped for, where the disease is a pure neurosis.

In those rare cases, in which some subjective phenomena of the *aura*-type in a limb prelude the fit, the attack might be stopped by the timely application of a ligature.

1465. (c) The design of lessening the *tendency to paroxysms* may be carried out on three plans:—

(1.) An effort may be made to break the *spasmodic habit* by counter-irritation of the dorsal spine, or of the nucha; by strychnia in very minute doses; by gentle electro-galvanism steadily repeated in the course of the vagi and phrenic nerves; and by the use of certain nervine tonics, especially the chloride or iodide of arsenic, the nitrate or oxide of silver, and the valerianate, phosphate or sulphate of zinc.

(2.) We may really cure the complaint sometimes by nullifying co-existent local or constitutional mischief. The removal of bronchitis by ordinary measures; antagonism of the syphilitic poison by mercury, iodide of potassium,† or the waters of Aix-la-Chapelle; an occasional course of colchicum, if the patient be gouty; of the bromide of potassium, where obvious erethism of the genital organs exists: have all been productive of great relief or actual cure. Removal of some gastric ailment occasionally puts an end to asthma; but, on the other hand, similar cures of similar gastric suffering will sometimes induce the spasm in a non-asthmatic person: this I have actually, though very rarely, seen.

(3.) Change of air often proves the very salvation of these patients; but the kind of change that shall prove beneficial in any individual case can only be learned by experience. Some sufferers lose their paroxysms south of the "olive line;" others are easiest in a cold atmosphere; moisture, the bane of one,

* J. R. Reynolds, M.D., in "Lancet," Oct. 29, 1863.

† It may be doubted whether iodide of potassium proves of the least service, except when the antecedents are clearly syphilitic.

greatly mitigates the disease in another; any notable fall in the barometer induces a paroxysm in one, wards it off in his next-door neighbour. A sea-side atmosphere protects some from seizures, excites them in others. The air of towns suits many, that of the country not fewer; the relatively clear suburban air of London is infinitely more noxious to a certain share of asthmatic persons than the foul atmosphere of the worst-cleansed, most revoltingly ill-smelling and most densely-peopled localities of the metropolis; * occasionally an individual will be found who is tortured with asthma in one room of a house, free from it in all the rest,—and this without any distinct explanation being found either in the aspect, the drainage, or any other known condition. The amount of insolation is not without its influence; and complete darkness has been observed to promote seizure in some individuals. I know several asthmatics who have a great craving for light during the paroxysm.

Regulation of the diet, as to quantity and quality alike, is of primary importance. Many asthmatics never dare eat to full contentment. I knew a man in whom sweet champagne invariably induced a fit; another who could not eat *white fish* without paying a similar penalty.

(II.)—PARALYTIC BRONCHIAL ASTHMA.

1466. Laennec ascribed the peculiar air-distension of the lungs, found in persons asphyxiated by the mephitic gases of cesspools, to paralysis of the vagi nerves; Mr. Swan noticed similar distension in animals whose eighth pair had been divided in the neck (*vide* NERVOUS APNŒA). In both cases the contractile force of the bronchial muscles, concerned in expiration [589 (*h.*)], is more or less completely annulled.

If then, as we have seen, there be motive to believe that true dynamic asthma depends, as a rule, on spasmodic action of the bronchial muscular apparatus, here are speculative reasons for

* A man, one of the greatest sufferers from asthma I ever saw, lived in the neighbourhood of Uxalk Farm, the parsonage of Hanpstead flowing across his house. Well nigh every known remedy had, in vain, been tried for his relief. He was accidentally detained one night in the foul region of the Seven Dials, feeling persuaded he could not possibly survive till morning, so great was his dread of the low atmosphere. He not only lived through the night, however, but enjoyed the first uninterrupted sleep he had known for months. He took the hint, removed to the Seven Dials for the *length of the year*, and when I last saw him, some six months after the removal, continued, though still a wheezer, perfectly free from serious dyspnoea. The late Mr. Dalrymple, the curate, told me he had more than once, when called into the country to operate, been obliged to return to town by the next train without even seeing the patient, so intense was the paroxysm induced by some varieties of country air.

presuming that paralysis of the apparatus may cause an exceptional variety of the affection. Clinically, too, we meet with examples of asthma in which the comparative facility of inspiration, and difficulty of expiration, coupled with the deficiency of the usual amount of dry rhonchi, suggest of themselves the probable existence of a minus, rather than a plus, state of power in bronchial contractility. Possibly such cases are those habitually most benefited by strychnia and galvanism.

This view is, however, far from being unopposed. Dr. Salter (op. cit. p. 21), for instance, adopting the prevailing theory that the bronchial muscles "are not, because they can not be, muscles of respiration," refuses to admit a paralytic variety of asthma. There are many clinical facts, now taking rank as accepted truths, which were once said "not to be, because they could not be," on the assumption that the conventional physiology of the hour was true. It seems to be a law of nature, that, where circular fibres embrace a tube, they are designed to influence the movement of its contents; why should the bronchial muscles have been created on a different principle? *Experientia fallax!* Dr. Salter may urge. True; but *experimenta fallaciora*.

I.—HEMIC DYSPNOEA.

1467. Difficult or distressed breathing, produced by morbid conditions of the blood, is far from rare. Some of its varieties deserve brief mention here, were it only for the purpose of guarding the student against errors of diagnosis. In all such morbid conditions, known clinically to produce disturbed breathing, the act is increased in frequency to make up for the deficient amount of oxygen supplied to the system by each separate inspiration.

1468. The different species of hemic dyspnoea may be arranged, as follows, on the basis of the dominant existing defect in the blood:

(a.) Element deficient	{ Anæmia.
	{ Leucocythæmia.
(b.) Arterialization imperfect. . .	{ Cyanæmia.
(c.) Proportion and quality of	{ Scurvy.
chief ingredients changed.	{ Pæmora.
	{ Uræmia.
(d.) Abnormal ingredients added,	{ Chloræmia.
plus other changes	{ Icterus.
	{ Pyæmia.
	{ Diabætes mellitus.

1469. In all these species the dyspnoea possesses the same essential characters. It impresses a bystander like the breath-

lessness following over-exertion in health; and among the varieties of dyspnoea from organic causes most nearly resembles the cardiac. The respiration is, absolutely speaking, not frequent in the degree of its objective labour, and is not seriously out of proportion with the pulse: the ratio, indeed, may be 5 : 1,* usually the subjective sensation of want of breath is, comparatively speaking, little felt.

1470. *Physical signs.*—The respiration, exaggerated, somewhat raised in pitch, and dry in quality, remains free from rhonchal sound of any kind: the percussion-results prove either normal, or indicative of excess of air in the cells.

1471. The mechanism of this hurried breathing is probably in all cases reflex; but the immediate rationale of the excited action must clearly vary. In anæmia and in leucœmia, for instance, the mere instinctive sense of want of oxygen, appears to hurry the act; in both there is a deficiency of red corpuscles, in the latter the difficulty is increased by the excess of the white. In diabetes and uræmia the morbid elements in the blood probably play the part of excitants to elimination by increased frequency of respiration.† Cyanæmia, the state of blood existing in cases of permanent obstruction through the heart and in cynosis, adds its share to the causes of difficult breathing in those affections.

1472. The *diagnosis* of this form of dyspnoea is to be made in the main *per viam exclusionis*: the absence of disease of the lung,‡ heart, and great vessels, and of spasm of the tubes must be substantiated,—while to this negative evidence must be added the presence of the specific signs of some one or other of the blood-diseases named.

1473. Should there be any real suffering with this form of dyspnoea, it may be mitigated by opium, and by various antispasmodics; while its cure is of course contingent upon that of the blood-state present.

II.—EPIDEMIC CATARRH OR INFLUENZA.

1474.—Epidemic catarrh, or influenza, holds a place among general, or acute specific, diseases, and obeys the laws of the group.

* Ellis, U. C. H. Males, vol. xi p. 110. Unemic dyspnoea: "breathes like a man out of breath from running, nervily; says feels short breathed; does not look as if suffering therefrom." Pulse 112, Resp. 22.

† The ordinary difficult breathing of senexy (and which I presume to depend, when there is no hæmorrhage into the lung, on the composition of the blood) may give place to intense and fatal dyspnoea of a peculiar kind, plausibly ascribed by M. Perrin (Union Méd., 1857) to acrobatic branny induration of the diaphragm.

‡ It must not be forgotten, too, that pulmonary affections may arise as insidiously as suddenly in various blood-diseases,—as, for instance, oedema of the lungs in uræmia.

Considered in its local anatomical conditions, it claims relationship with affections of the respiratory passages, rather than any other, though its morbid influence be by no means limited to these.

1475. *Invasion*.—The seizure of influenza is in the mass of cases strikingly sudden; it may, however, be preceded by general uneasiness of two or three days' duration,—but never, as far as proved, by a true incubation-period. The disease sets in with lassitude, chilliness, slight shivering, very rarely actual rigors, and aching pains in the limbs, sometimes of much severity. At the outset the specific irritation quite as frequently affects the mucous membrane of the throat and palate as that of the nose and air-passages.* Nausea and vomiting may prove the symptoms of invasion, —preceding all others, and showing that the upper part of the alimentary canal participates from the first in the disease.

1476. *Symptoms*.—The Schneiderian membrane, at first dry and subjectively hot, soon becomes the seat of flux, watery, saline, and profuse; epistaxis rarely occurs; mid-frontal cephalalgia, sometimes very severe, and attended with a feeling of internal rawness at the spot, probably depends on implication of the lining membrane of the frontal sinuses.

The chest-symptoms are: cough of variable severity; sometimes intensely violent, at first dry, then accompanied with expectoration, scanty and pituitous, eventually free, copious, and mucopurulent; slight dyspnoea; tightness, soreness, and uneasy pain behind the sternum; irritation in the trachea; intercostal neuralgia; thoracic myalgia; and pain, with or without tenderness, in the costal bones and periosteum.

The tongue red at the tip and edges, creamily furred at the centre,—with tenderness under pressure, and sensation of rawness at the epigastrium; nausea; occasional glairy, very rarely bilious, vomiting; loss of appetite, even to complete anorexia; and, lastly, diarrhoea, generally of but trifling importance, succeeding to constipation; all prove implication of the alimentary canal.

Frontal and intra-orbital headache; vertigo; tinnitus aurium; restlessness, perhaps slight wandering, at night, are commonly present.

The pyrexial symptoms wear a more or less adynamic character: the pulse, though at first it may be full, becoming small and feeble

* Some writers, for instance, Toulmouche (*Gazette Med. de Paris*, 1847), recognise two forms of the disease: the one affecting merely the nostrils, larynx, and throat, the other, the gastrointestinal and pulmonary mucous tracts. In the opportunities which I have witnessed such distinct dissection of the symptoms of the different mucous membranes could not certainly be detected.

at an early period, rarely grows very frequent, sometimes slackens, with the advance of the disease. The pulse-respiration ratio generally undergoes but slight perversion,—for instance, to 3·3 : 1. The urine affects the febrile type. The skin, at first dry and hot, subsequently variable in temperature, never raises the thermometer seriously or proves acridly burning to the touch.

Lastly, pains in the neck, scalp, and over the malar bones; extreme general uneasiness; aching pains and soreness of the limbs and trunk,—all combined with excessive depression of spirits, and an amount of debility and prostration totally out of proportion with the local ailments (syncope sometimes occurs in the erect posture)—complete the list of symptoms of the established disease in its ordinary and pure form.

There are exceptional cases where violent headache, flushing of the face, and low muttering delirium, with adynamic fever, are the prominent symptoms; others, where the digestive organs suffer almost solely, and in the upper parts; others marked by diarrhoea or pseudo-dysentery; and yet others, where erethism or actual catarrhal inflammation of the urinary passages* (pyelo-cystitis) proves the main phenomenon. In all these cases there is, however, a substratum of the ordinary naso-bronchial symptoms.

1477. *Physical signs.*—The physical signs are those of bronchitis (dry rhonchi with loose bubbling on a limited scale at one or both bases), or there are none of positive character; I have noticed this deficiency of notable bronchial signs, even where cough and post-sternal pain existed to a very appreciable amount.

1478. *Terminations.*—The pyrexia of pure influenza generally terminates in three or four days in mild cases, lingering on in the severer ones to the end of the first or even second week. Commonly diaphoresis,—much more rarely some form of herpetic eruption†—sometimes a copious deposit of lithates—ushers in convalescence. Recovery long continues imperfect,—extreme general debility, dislike to mental and bodily exertion, peevishness of temper, and want of appetite, mark the enduring effects of the disease on the system at large. Great local annoyance is sometimes occasioned by rheumatic periosteitis of the bones of the face, with considerable tenderness under pressure, holding on for days, or even weeks, after the other symptoms have yielded.

* I have seen this, however, once only in an old sufferer from stricture of the urethra.

† Herpes labialis sometimes occurs without any change either for better or worse in the pyrexial symptoms.

1479. *Complex cases.*—It seems not to appertain to the essence of influenza to produce either bronchitis *per se*, severe pneumonia or pleurisy; but, especially in certain epidemics, any one of these affections separately, or two or all three of them in conjunction, are sufficiently common. When occurring, are they to be regarded as evidence of complete evolution of the influenza-poison, as secondary lesions, or as complications? The data for settling this very important point in the theory of the disease have not yet been collected: meanwhile the practical significance of the two former, especially, of these inflammations renders it necessary to briefly consider them apart.

1480. *General and Capillary bronchitis.*—Absence of acute pain; well-toned pulmonary resonance in spite of accumulating secretion, showing marked general lung-distension; notable disproportion of the dyspnoea and asphyxial signs to the apparent physical disturbances in the chest; all exist in the capillary bronchitis of influenza as in the idiopathic disease. But the prostration of strength is of yet earlier occurrence, and more marked in amount. Collapse of lobules is perhaps even more frequent, and the secretion in the tubes more viscid, than in the simple primary inflammation. Death occurs more rapidly than where the influenza-element is wanting,—generally taking place between the sixth and twelfth or fourteenth days.

1481. The *pneumonia* of influenza differs from that disease in its primary form by the greater freedom from pain,—the less amount of perversion of the pulse-respiration ratio, in consequence of the relatively greater increase in frequency of the pulse, —the absence of acrid heat of the skin,—(hence generally by a disposition to latency); and by the frequent association of capillary bronchitis.

In the Paris epidemic of 1837, especially towards its close, the bronchi of the hepatized lobes, according to M. Nonat,* often contained moulded casts, as in plastic inflammation; but it does not appear to have been known to that writer that these casts occur, though rarely, in primary pneumonia [1806]; their specific significance, though not their reality, may hence be questioned.

1482. *Relapse and recurrence*† are both common. It seems to be generally conceded that the symptoms in cases of recurrence need not be the same as in the primary seizure,—that “angina,

* Recherches sur la Grippe; Archives de Médecine, 1837.

† By the former being understood return of the specific phenomena of the disease before, by the latter after, the completion of convalescence.

intermittent fever, and various anomalous local affections," occurring after an attack of ordinary influenza, may simply be a new form of expression in the workings of the old poison. This is a piece of pathological doctrine involving consequences probably unforeseen by those originating it, —one resting on simple conjecture, and to be absolutely rejected until something like proof of its soundness be tendered.

Somewhat allied to this idea is another which may be glanced at here. It is a matter of certainty that during the prevalence of influenza, other acute disorders often assume what may be called an *influenzoid character*. The cause of this peculiarity (not limited to epidemics of influenza) is mysterious enough; but whatever that cause be, the fact seems to explain a notion, which has found defenders, that the poison of influenza may produce typhoid (Peyerian) fever, and various grave abdominal diseases. That the poisons of influenza and of typhoid fever are thus interchangeable, seems a heresy undeserving serious refutation.

1483. *Sequelæ*.—Influenza almost invariably leaves, as its sequence, more or less abiding debility,* and, in many cases, chronic bronchitic cough. That the symptoms of phthisis have occasionally first become apparent after an attack of influenza, is unquestionable; and the fair inference is that it accelerated the outbreak of the tuberculous disease,—but that influenza, unassisted by the phthisical diathesis, may produce consumption, cannot be admitted.

1484. *Prevalence and mortality*.—Influenza is indubitably one of the epidemics that, once developed in a locality, spreads most extensively. The Registrar-General † calculates that one-fourth, Sir H. Holland ‡ one-half of the population of London, suffered in the epidemic of 1837. These calculations, resting on no solid foundation, are in all likelihood exaggerated,—still the number of persons seized is generally immense. Fortunately the virulence of the disease falls far short of its activity,—two per cent. of those attacked being probably a fair estimate of the average mortality. Influenza, in truth, scarcely ever kills those it affects, unless, aged and debilitated, they have already one foot in the grave. Among

* A favourite piece of belief is that this general weakness gives a proclivity to *seizure* by all varieties of dynamic, virus, and miasm diseases. But far from this being certain, such activity may, for aught that has been established to the reverse, actually constitute a protection against all such affections. Vide Lectures on Influence of State of Health on Disease, *Lancet*, vol. x., 1871.

† Report on Influenza.

‡ *Medical Notes and Reflections*, 3rd ed., p. 327: "Perhaps few escaped the influence altogether."

this class of the population, the mortality has sometimes proved very serious: still, inasmuch as these persons were already in a condition to be cut off by a variety of other diseases, it turns out that an epidemic of influenza, except in rare instances,* feebly raises the average rate of mortality. Females appear to die in greater proportion, both to the population and to the number seized, than males. Death is much more frequently due to capillary bronchitis than to pneumonia: the converse statement could only have arisen from the long subsisting confusion between "peripneumonia notha" and true pneumonia in the aged.

1485. *Dissemination*.—Epidemics of influenza have been recorded for upwards of three hundred years; successive visitations have occurred at excessively irregular intervals; their course, though uncertain, has in the main been from east to west, leaving some places in their route untouched; rapidity of dissemination, ubiquity, and simultaneous outbreak at spots widely distant, have almost always been striking features. The sea offers no barrier against the advance of the disease,—it has occurred in solitary mid-ocean islands, as in ships far from land.

1486. *Duration*.—The duration of past epidemics in a given locality appears to have averaged about six weeks. Obviously the cause lingers in spots after the disease has disappeared,—for new comers are often seized some time after the inhabitants (all susceptible individuals among them, it may be presumed, having passed the ordeal) have ceased to suffer.

1487. *Ætiology*.—The study of precursory peculiarities in the public health, and in meteorological conditions, affords no clue to the causes of these outbreaks: every condition, *a priori* conceivable, has actually precluded an epidemic. What boots it to show that a certain epidemic was preceded by intensely cold and stormy, when "with warm and apparently genial" weather,† the disease may be almost universally diffused? Obviously there is a something beyond the indications of the barometer, thermometer, and hygrometer to be looked to in explanation of the disease. The connection of particular electrical states with its appearance is less clearly established than was at one time supposed,—and that ozone really acts as the exciting cause, cannot be held to be proven. Still from a very careful analysis of the diseases in Vienna for a

* An epidemic at Rome in 1780 is said to have destroyed 2000 persons; but the estimate is probably to be taken *cum grano sale*.

† At the Cape of Good Hope, in H. Holland, loc. cit., p. 328. The London epidemic of 1844 occurred in May, June, and July.

period of ten years, taken in juxtaposition with the fluctuations in the amount of ozone, Dr. Carl Haller* shows, that catarrhs and pulmonary inflammations rise and fall in frequency very much in the ratio of the ozone.

The sudden, almost simultaneous occurrence of the disease in various distant places,—the seizure, almost at the same hour, of different and wholly disconnected portions of a population,—the certainty that people occasionally freely mingle with affected families and escape,—while others, arriving in an influenza-district, are seized before they have held communication with the inhabitants,—the absence of proof that the disease has ever sprung up in an unaffected district, or even street, immediately on the arrival of persons who have suffered, or are yet suffering, from it,—the want of evidence as to the existence of a period of incubation:—all these circumstances show that influenza is not a virus-disease, transferable by an affected to an unaffected person,† but that the seizure of each individual is wholly independent of the suffering of his neighbours,—that the cause is some undiscovered atmospheric or telluric poison, and that influenza may be held to typify the pure non-infectious, *de novo* or *miasm*, family of epidemics.

This poison seems specially to exercise its influence on parts supplied by the pneumo-gastric nerve; and it is worthy of remark that hooping-cough, an affection in which that trunk is indubitably concerned, has often been noticed to prevail concurrently with influenza.‡ The local disorders in simple cases seem scarcely to reach the inflammation-point; in the graver class, as where plastic casts form in the bronchi, the actuality of inflammation cannot be questioned. Whatever be the nature of the poison of influenza its activity is apparently not limited to the human species. At least epizootic diseases of essentially the same characters sometimes coincide with, precede, or follow epidemic influenza: horses, dogs, sheep, and cows seem to have been the chief sufferers.

1488. *Treatment*.—(a) There is no antidotal treatment for influenza known,—nor any convincing evidence extant, that the disease may be arrested by art at the outset. As is sufficiently known, there is scarcely a disease under the sun which our fore-

* Das Ozon, &c. Separat-abstract aus dem Jahresbericht des K. K. Krankenhause Wien, 1870.

† I am not aware whether inoculation of the human being with the blood or secreted fluids of patients with influenza has ever been essayed; the experiment seems to have had negative results in the horse.

‡ E. g., H. Holland, loc. cit., p. 342.

fathers were not in the habit of thus readily arresting by an emetic,—influenza, of course, one of the number. At the present day, unfortunately, emetics have lost their ancient efficacy. I have known obstinate vomiting of three days' duration follow an emetic dose of antimony at the outset,—and, where some immediate relief of chest-obstruction has ensued, this has commonly been dearly paid for by increased general depression. But I record this unfavourable estimate with the qualification that it is not quite in accordance with that of some modern writers.

(b) The experience of centuries has established, beyond question, the impropriety of depletory measures, as a general rule, in the treatment of influenza. The Czar of Russia might at least plead in justification of his ukase against blood-letting, the mortality clearly traceable to the practice, not only in his own dominions, but in various countries of Europe,—England, France, Spain, Italy. I more than doubt if the occurrence of consolidation-signs even warrants the use of the lancet. Such signs are observed chiefly in aged persons and in those exhausted either by previous disease, debauchery, or destitution; and I know, from experience, that dry-cupping and sesqui-carbonate of ammonia will remove these signs in cases of the stamp; whereas I have never seen any unquestionable benefit derived from abstraction of blood, either by leeches or scarification. Such consolidation is very positively *passively congestive* in the aged and infirm, and is increased by depressing measures. Should well-marked signs of sthenic pneumonia occur in a young or middle-aged person, leeching or cupping may be advisable;—but even then the extremest caution is requisite; a dozen leeches have, within my experience, produced successive fainting fits in a previously healthy and robust individual. I have never seen a case in London where venesection seemed advisable; possibly such may occasionally be met with among the more vigorous inhabitants of rural districts. Neither should tartar emetic, active purgatives, nor (I think, in spite of the encomiums of Dr. J. Davies) mercury, with a view to its constitutional action, be employed.

(c) The treatment I have found most successful, is as follows: Keep the patient in bed; open the bowels by some gentle laxative; give diaphoretics in combination, especially if there be rheumatic pains, with colchicum and an alkali; procure sleep by extract of lettuce, or of hyoscyamus, or by chloral; and allow diluents freely. After the first three or four days, if bronchitic rhonchi exist, a blister should be applied between the shoulder-

blades or to the sternum, and an expectorant mixture prescribed. This mixture may with advantage be somewhat stimulant;—let the vehicle, for example, be ammoniacum, serpentaria, or decoction of senega; lobelia inflata, in small doses, and paregoric should enter into its composition. Tonics, iron, and quinine may be given daily during convalescence, unless the stomach have been implicated to any amount. If there be much exhaustion from the first, sesquicarbonate of ammonia and strong beef-tea should be given without hesitation; and the free use of wine or brandy may at an early period become imperative.

(d) It follows from what has been said in a previous paragraph, that segregation of patients is not necessary, as a means of preventing the spread of disease.

III.—HOOPING-COUGH OR PERTUSSIS.

1489. Hooping-cough, or pertussis, seems, clinically speaking, composed of specific bronchitic irritation,—the specific character being sufficiently indicated by the qualities of the secreted product—and of reflex spasm of the air tubes, more especially declaring itself in laryngismus.

1490. *Course and Symptoms.*—Three stages of the disease may be recognised: the catarrhal; the spasmodic; the terminal.

1491. (I) The *catarrhal* stage is marked by coryza, general irritation of the air-passages, dry or almost dry cough and feverish disturbance: the pyrexia may be severe, and is, in rare instances, attended with marked nervous excitability and even slight nocturnal delirium. If there be expectoration, it is in no wise distinctive in character. The cough sometimes has a tendency to recur paroxysmally, but there is nothing peculiar in its actual characters.

1492. From ten days to a fortnight appears to be the mean period of duration of this stage; the extremes three or four days and three weeks.* It may be wanting altogether,—a deficiency noted in about one of fifteen or twenty cases.

1493. (II.) The commencement of the *spasmodic* stage is announced by the distinctive paroxysms of cough occurring at irregular intervals by day and night. Each fit may be abrupt in its occurrence, or preceded by tickling in the trachea and uneasy sensations in the chest and throat,† of sufficient duration to give full warning of its approach.

* In an epidemic at Geneva, Lombard found it sometimes protracted to the sixth week.

† Suggestively looked upon by Romberg as "the aura of the vagus."

During the fit of cough expiration and inspiration are in their several ways laborious. Expiration consists of a variable number of forcible puffs (there may be as many as twelve or fifteen), rapidly succeeding each other, without obvious intervening inspiration, and performed with almost convulsive energy. These successive expiratory efforts seem to force all the supplementary and some of the residual volumes of air from the lungs [122], and it is often not until some of the minor phenomena of asphyxia become apparent, that the patient obtains relief by a prolonged cooing, so-called hooping, inspiration. The labour of inspiration comes of the difficulty of overcoming the temporary lung-collapse produced by the excessive expirations, and the more or less marked laryngismus. The louder the hoop, the more complete, probably, the relaxation of the glottis: an imperfect hoop is consequently of unfavourable significance. Expiration is the bane, inspiration the antidote.

A single fit rarely lasts more than half to three-quarters of a minute: relief then comes, at least, for a moment. But a complete paroxysm, consisting of a variable number of these fits, may hold on for a quarter of an hour or upwards. When thus prolonged, not only do the face and eyes become painfully turgid and livid, but blood may issue from the mouth, ears, and nose; * the conjunctivæ become ecchymosed; copious cold perspiration breaks out; slight convulsions occur; hernia may form; violent vomiting and involuntary discharge of the feces and urine may take place, —the latter clearly of expulsive and not of paralytic mechanism. The pulse is frequent, greatly out of proportion to the number of inspirations; but it becomes natural, unless some complication exist, after the close of the paroxysm.

The paroxysm terminates commonly by expectoration (during the early part of this stage, thin, scanty, and pituitous: during its more advanced part, rosy, semi-transparent, albumen-like); or by vomiting;—or by pure exhaustion, without discharge of any kind. And in a period varying from a quarter of an hour to a few minutes, or even in some cases seconds, the patient feels as in health, except from some slight sensation of fatigue, and, if a child, resumes his play, as though nothing had happened. But in grave cases considerable pain in the region of the diaphragm, with disturbed breathing, may hold on for several minutes; fainting may occur; or there may be various indications of venous congestion within the head.

1494. The frequency of recurrence of the paroxysms varies

* Epistaxis, dangerous per se, has sometimes been observed

greatly; there may be but two in a day, or two or three per hour. Sometimes ensuing without any immediate excitation, they are more frequently traceable to such influences as irritate the excitatory system,—the act of swallowing, sudden draughts of cold air, a fit of anger, abrupt movements of the body: like spasms of reflex mechanism generally, they sometimes come on by night; and it has been remarked, the severer the disease, the more frequent and violent the nocturnal seizures.

A fit is occasionally excited in a child, already affected, by imitation (even hearing the cough is sufficient to set this mixed psychical and reflex mechanism in action); but that the disease has ever been thus produced *ab initio* seems a fancy wholly unsupported by facts.

1495. The mean duration of the convulsive stage seems to fall between thirty and fifty days; but it may terminate by the third week (not at an earlier period, as far as I have seen), or be protracted for three months or even upwards.

1496. If the disease be simple, and of moderate duration, the general health scarcely suffers. The nutritive functions are naturally performed; the strength keeps up; the spirits of the child do not flag. But when the cough lasts long, failure of strength and wasting take place; and though, as far as I know, death does not occur by mere asthenia of this sort, it evidently helps to a fatal issue.

The urine may become saccharine, the quantity of sugar being generally insignificant: sometimes, it is alleged however, the specific gravity rises seriously, and a diabetic state of clinical importance is established.*

1497. (III.) During the *terminal* stage, the cough, becoming less frequent, loses the convulsive and hooping characters; the expectoration ceases to wear the albumen-like, ropy appearance, and becomes simply catarrhal. Eventually all symptoms disappear in the course of from one to three weeks.

1498. *Physical signs*.—These are, in the mass of cases, only negatively important; they exclude diseases which might erroneously be supposed to be present. During prolonged paroxysms, and especially towards their close, the percussion-sound temporarily loses in resonance, and rises somewhat in pitch: I state this from positive observation; but it is no more than might be expected from the forced evacuation of the air-cells that occurs. During the brief efforts at inspiration between the successive

* Gibb, "Lancet," January, 1858.

expiratory puffs of the cough, inspiratory sound may sometimes be caught; but during the noisy and hooping inspiration, very little true breathing-sound reaches the surface; probably spasm of the bronchial tubes prevents the tidal air from advancing towards the cells [122, 253]. Sonorous and sibilant rhonchi, and, if there be much fluid in the tubes, all the varieties of moist bronchial rhonchi, are heard.

The movements of respiration in the paroxysm are perverted, as already described, through the influence of tendency to collapse at the bases of the lungs [54]. If collapse, either lobular or diffuse, become a persistent state, a fresh series of signs may be detected. The respiration-movements grow more and more shallow; the percussion-note loses resonance posteriorly, and at the mid-front especially. True respiration-sound is inaudible, and not replaced by bronchial breathing, but partly covered by moist rhonchus. Though the expirations may rise to 60, 80, or even 100 in the minute (whence, though the pulse also is absolutely very frequent, complete perversion of the pulse-respiration ratio ensues), there is little of the subjective dyspnoea of capillary bronchitis or of the pyrexial rise in temperature of pneumonia,—the surface is, indeed, more commonly cool.

1499. *Relapse* of hooping cough is far from uncommon; genuine *recurrence* extremely rare,—as rare probably as of any of those diseases, of which one attack habitually confers immunity from a second.

1500. *Morbid appearances.* Hooping-cough is a disease without any truly distinctive anatomical character; nevertheless in fatal cases numerous textural changes are found.

Of these by far the most frequent, as originally shown by Dr. Alderson,* and recently insisted on by Dr. G. Hewitt,† is lobular collapse of the lungs [962]: absence of this state (which more nearly than any other holds the relationship of an anatomical character to the disease) seems to be the exception. Coupled with, and within the area of, this collapse, is occasionally found distension of the air-cells and terminal portions of the tubes with air and pus,—so called bronchial abscesses. The bronchial tubes are more or less uniformly inflamed; the larynx and trachea not obviously implicated; the lung-substance, in a moderate proportion of cases, lobularly or diffusely inflamed. Pleuritic changes are very rare. Emphysema, the result of the disease, and there-

* Med. Chir. Trans., vol. xvi., 1830.

† Pathol. of Hooping Cough, &c. &c.

fore of acute form, is pretty commonly seen adjoining collapsed tissue; dilatation of the bronchi has so seldom been actually found after death, that the reality of its dependence on the disease has been questioned.*

Autenrieth's notion that the vagus is inflamed has been satisfactorily disproved; nor does Romberg's hypothesis, that the nerve is irritated in whooping-cough by an inflammatory process in the adjoining bronchial glands, stand the test of observation,—though the spasmodic influence of such a process, when it exists, cannot be questioned (*vide* BRONCHIAL PHTHISIS).

1501. *Complications*.—The complications of pertussis are bronchitis, pneumonia, collapse of the lung, croup, continued vomiting (not explicable by the mechanical influence of the cough), diarrhoea, tympanitic distension of the abdomen, convulsions purely neurotic, or dependent on cerebral congestion, with drowsiness and coma, tubercular meningitis, bronchial phthisis and the exanthemata. The latter modify or arrest the cough during their periods of invasion and status.† The cough has been observed to cease during the ague-fit (Romberg).

I have seen cases where pigeon-breast has ensued on prolonged whooping-cough [54].

1502. *Causes*.—Whooping-cough occurs epidemically and is transmissible by infection. These propositions involve the necessity of our admitting a special animal virus as the cause of the disease. This virus has been theoretically supposed to exist in the air of expiration, independently of the material of expectoration, while the potentiality of the bronchial secretions and of the blood was looked upon as doubtful. But the infective activity of the secretion would appear from recent experiments to be scarcely questionable. Letzerich states he has succeeded in producing whooping-cough in rabbits by inoculating the trachea with the sputa of the human subject. These sputa, he maintains, always contain fungus.‡

The duration of the incubation-period has not been satisfactorily determined.

The infectious agent is portable in fomites. Of this fact Dr. Neil Arnott has related to me the following significant illustration. A lady left a port in the East for England with two children

* Yet Dr. Stokes says that "in young children affected with whooping-cough a period of two or three months is sufficient to produce the fullest development of bronchial dilatation"—*Dis. of the Chest*, p. 155.

† Wall on Chin Cough, 1813.

‡ *New Syd. Soc. Retrospect*, 1871, p. 147.

in the hooping-cough; the vessel put in at St. Helena, where the linen of the children was sent ashore to be washed: the children of the laundress were seized with the disease; and from them it spread generally through the island,—no case of the complaint having previously occurred there for a lengthened period.

The female sex predisposes to the graver forms of hooping-cough: at least female children are in this country destroyed more extensively by it than males; to 1,000,000 living of each sex in England and Wales, 546 males and 605 females (the mean being 605) perished by the disease in 1838.* It is most common before the fourth, becomes less frequent after the fifth, and excessively rare after the tenth year of existence.

Hooping-cough is an affection common to all varieties of climate. Epidemic seizures are most mortal, as a rule, in the cold quarter of the year: thus in 1837-8, in London, from October to March inclusive, there were 1522 deaths against 842 from April to September.

1503. *Mortality*.—Hooping-cough, a disease of extreme, but undetermined frequency, proves in some cases an affection so mild, with its special characters so feebly developed, that doubts may be entertained as to its having existed at all, while in others it is so severe as to jeopardise, or actually destroy, life.

The annual mortality in this country from pertussis is, in truth, most serious: thus in 1838 the deaths from this cause were 9107,—a mortality giving it actually the seventh place in amount of destructiveness in the Registrar's list of diseases.

1504. *Mode of death*.—Death has occurred from asphyxia, through rupture of the air-cells, and effusion of air into the mediastinum and common cellular membrane,—from rupture of the pleura and pneumothorax, and from the mere exhaustion of the protracted disease. But its complications, capillary bronchitis, pulmonary collapse, pneumonia, croup, convulsions during a paroxysm, tuberculous meningitis, and cerebral congestion are, commonly, the most active agents in destroying life.

1505. *Prognosis*.—The proportion of those dying to those seized being unknown, we want this fundamental element of prognosis: besides, the ratio varies materially in different epidemics. The younger the child, it is generally taught, the greater the danger. Females die in larger proportion to those attacked than males. The disease is generally more severe when epidemic than sporadic. No trust is to be placed in the mildness or severity of the catarrhal

* Registrar's Second Report, 1843

stage as a guide. Antecedent feebleness, the existence of pyrexia between the fits, and the various complications, are of evil import. The signs of well-marked collapse are commonly of fatal augury.

1506. *Diagnosis*.—There is no character as yet established, whereby the catarrhal stage can with surety be distinguished from common bronchial irritation: prevalence of the disease, or known exposure to infection are the only guides.

The diagnosis of inflammatory complications may be greatly aided by the rise of objective temperature. The thermometer may thus prove especially useful in distinguishing pneumonia from lobular collapse.

The diagnosis of the confirmed disease from bronchial phthisis has already been considered [710].

1507. *Nature*.—Pertussis appears to be a virus-disease, in which the poison has a special attraction for the pneumogastric nerve, and probably the connected portions of nervous centres: the convulsive character of the cough, the frequent vomiting independently of this, and the occasional saccharine state of the urine seem to point to such localisation. Still, all such ideas are for the present merely speculative. The seeming relationship of the disease to epidemic catarrh has already been referred to [1487].

In a certain number of cases small round superficial ulcerations form at the root of the tongue; hence the disease has been fancifully assimilated to hydrophobia,—an affection reflex-spasmodic in character, and attended with vesicle-formation in that locality.*

1508. *Prophylaxia*.—Satisfactory evidence of the alleged prophylactic efficacy either of vaccination or of belladonna is altogether defective.

1509. *Treatment*.—(a) In mild cases of whooping-cough little is required in the way of treatment. Attention to the state of the bowels, the use of gently soothing expectorants, limitation in eating, warm clothing, and avoidance of all the *latentia*, more especially of sudden excitement, emotional and physical, with, if possible, immediate remove to a warmer and drier atmosphere † than that in which the disease has been contracted, comprise all the precautions needed.

(b) When the disease is of grave character *per se*, is it possible to modify its course by treatment, or is the dictum of Romberg correct? “We know of no method by which we can arrest the pro-

* Lersch, in *Journ. für Kinderkrankheiten*, 1844.

† More chance of the kind, without any superiority of atmospheric conditions, will often favourably modify the complaint.

gress of the disease or shorten its duration—we have not even the negative advantage of finding that certain methods of treatment *increase* the symptoms." But, conceding the fact of our incapacity in this aspect, a great deal remains for the physician to accomplish in the relief of suffering and the management of complications.

(1.) During the catarrhal stage (assuming the symptoms are from circumstances known to be precursory of pertussis), if the irritation be severe, antimony, or ipecacuanha, in doses measured by the patient's age, are desirable. Unless the symptoms are sharply inflammatory, blood-letting in any of its forms should be avoided; the disease must run a certain course, and the patient's strength requires husbanding.

Various means of lessening the severity of the paroxysms may be had recourse to. Nauseants, given also occasionally in emetic doses, are among the best of these,—antimony, ipecacuanha, and lobelia inflata, especially the two latter, in combination. Antispasmodics, such as asafetida (if unbearable by the stomach, rubbed over the epigastrium and spine), musk, valerian, and camphor, answer well in some cases. Of narcotics, hyoscyamus, lettuce, and conium are the safest; opium should not be given unless in combination with ipecacuanha. Tincture of Cannabis Indica, in the dose of a drop for each year, and mixed with sugar, has been strongly recommended. Belladonna, pushed to the verge of poisonous effects, is sometimes a justifiable remedy, where the paroxysms are dangerous *per se*; I have used it with the unquestionable effect of mitigating their severity and frequency, but I have no evidence that it shortens the disease. Hydrocyanic acid, as a rule, is a fitter agent; and may be trusted to throughout as the most direct sedative of the spinal cord: could generalisation be allowed from a small number of cases (which unfortunately it cannot), its use would appear to bring the duration of the complaint sensibly within the mean.* Chloroform, in doses of from three to ten minims, and chloral, in doses of five to eight or ten grains (according to age), lessen the severity of the fits. Coffee, as strong as it can be made by Loysell's apparatus, in doses of half a drachm to one or two ounces, acts similarly, and with singular efficiency, in some individuals. Dr. Unsicker (Gin. Lancet and Observer) reports favourably on the use of strong tea made of the dried leaves of the common chestnut tree (*Fagus Castanea*) not

* A. B. Grassville, "Treatise on Hydrocyanic Acid," London, 1829.

only in mitigating the paroxysms, but in shortening the duration of the disease.

Counter-irritation of the chest by croton oil, or acetic acid and turpentine, is decidedly useful: such applications should be used of low strength. Tartar emetic is to be avoided. A blister kept on for two or three hours, and followed by a linseed poultice, sometimes greatly lessens irritation for several days. Belladonna-frictions to the spine, or a broad strip of belladonna-plaster extended from the nape of the neck to the loins, very often prove distinctly serviceable. Morphia, applied endermically to the throat, is favourably spoken of; and there is much theoretical argument in favour of the frequent repetition of small blisters at the nape of the neck.*

A draught of cold water, or the cold-water-dash to the face, will sometimes put a passing term to a fit. The shower-bath, in the case of children, generally does more harm than good. And we are not likely at the present day to revert to our ancestral system of "curing" the disease by exciting sudden and violent fright.

Chloroform-inhalation may be had recourse to in bad cases: of its influence in shortening the paroxysm, and weakening the force of the spasm, there can be no doubt. The quantity inhaled should be just sufficient to produce slight cutaneous insensibility, never to bring on narcotism.

Touching the orifice of the glottis with a strong solution of nitrate of silver sometimes lessens the irritability of that part: the process will, it is alleged, remove the disease, if employed for eight or ten days. *Per contra* it may very sensibly increase the severity of the paroxysms.

Of various alleged *specifics*, such as *vaccination*, *sulphuret of potassium*, *cochineal*, *nux vomica*, *arsenic*, and *cantharides*, nothing satisfactory can be said. *Alum*, in small and repeated doses, extensively tried by Mr. W. B. Hutchinson at the Foundling Hospital, appeared to him, though wanting in the specific virtues announced, to shorten somewhat the average duration of the disease, and render the paroxysms less violent: even this modified estimate is more favourable than is justified by anything I have seen. The disease never, according to Arnoldi, resists longer than three weeks the influence of *nitric acid*, diluted to the acidity of lemon juice, freely used; a child, aged two years, took in this form one and a half drachms of concentrated nitric acid in the day with "the best effects." Specifically curative properties have been

* Holl, "Med. Times," April, 1859.

ascribed to the air of *gas works*. Assuming this to be well founded, Lochner has given *benzine* in small doses internally,—sprinkling it also over the bed-clothes. In his own child (twenty-one months old) treated thus, “the premonitory symptoms lasted eight days,—the disease itself six.”*

During the first and second dentition, the teeth should be carefully looked after. Flannel should be worn next the skin; a uniform temperature maintained about the patient as far as possible; and, if the complaint set in towards winter, and removal to a warm locality be impossible, he should be confined to the house absolutely.

Towards the close of the disease change of air, as in the somewhat analogous case of laryngismus stridulus, proves of signal benefit; and now it is that the utility of iron,† and nerve-tonics, such as oxide, sulphate or valerianate of zinc and nitrate of silver, cannot be questioned.

The disease being infectious, segregation is required. How long the virus retains its specific qualities, and when it attains its maximum activity, are queries to which it rests with the future to reply.

(2.) *Complications*.—Inflammatory conditions arising during the convulsive stage should be less antiphlogistically treated, than if pertussis were absent. I cannot resist the evidence of my own experience on this point though I find a different notion held by some commendable writers.

Pulmonary collapse, on a scale sufficient for diagnosis, is the signal for actively supporting and stimulant measures.

SECTION X.—DISEASES OF THE MEDIASTINA.

I.—MEDIASTINAL TUMOR.

1510. *Nature of Tumor*.—I have seen in the mediastina tumors, composed of simple exudation-matter, scirrho-encephaloid, encephaloid, fibrous, and fibre-fatty substance: masses of steatoma and hair have been described by others. The local symptoms and the physical signs (inasmuch as both are mainly of mechanical origin) are almost identical, whatever be the constitution of the tumor.

1511. *Physical signs*.—(a) When a tumor occupies the mediastinum, and encroaches, as it commonly does, mainly in front, visible

* *Ann. Méd. de Paris*.

† Some kinds of iron has, on insufficient grounds, been put forward as capable of cutting short the disease.

bulging of the sternum and costal cartilages, in a variable spot and to a variable superficial extent, may exist; the intercostal spaces, widened and flattened, are then unaffected by respiration: but, on the other hand, no shadow of bulging may exist, and yet from other signs the presence of tumor be indisputable.

(*b*) Wherever a tumor, of any thickness, reaches the surface, vocal fremitus is annulled, unless it lie in close connection with the trachea or a large bronchial tube. Fluctuation, simple or peripheral, is not to be detected; and a double impulse is sometimes transmitted from the heart (more rarely from the arch of the aorta), and may be felt both by observer and patient as a sort of inward succussion.

(*c*) If the tumor encroach pretty equally on both sides of the chest, there may be no alteration in their relative semi-circular measurement, though both, absolutely speaking, are dilated. Measurement in motion shows that the respiration-play is impaired, and the impairment may fall rather on expiratory retraction than inspiratory expansion. If by chance either main bronchus (and it is much more frequently the right that suffers) be seriously obstructed, the respiration-play will be relatively deficient on that side, independently of the influence of any general excess of solid mass within the right thorax. Should the tumor encroach notably on one side or the other, and be at the same time adherent to the wall of the chest, the space between the middle line and nipple will be lengthened on the same side.

(*d*) No uniform character of percussion-note appertains to mediastinal tumors. The thickness of the mass, the sonorousness of its own proper substance, the closeness of adhesion to the chest-wall, its relationship to the trachea and large bronchi, vary materially in different cases, and entail differences in the percussion-results. Thus are explained the facts, that the note may be fairly pulmonary; excessively dull, and toneless [Type I. 195]; high-pitched and hard with sharp resistance [Type III. 199]; or either tubular or amphoric.* There is commonly highly-marked parietal resistance.

The superficial dimensions of the growth may usually be traced in the front or in the spinal regions behind by careful percussion of graduated force. The resistance and mode of resonance of the heart and liver commonly differ from those of tumors; and hence,

* Near the trachea, or more generally in front, or even in the back, the percussion-note may be tubular, or even amphoric. I have known it amphoric over the entire lower half of the right back.

if those organs chance to lie in close juxtaposition with an adventitious growth, their neighbouring edges may be defined by simple or by auscultatory percussio [467*].

(e) The auscultatory signs also vary widely. The respiration may be weak, almost to suppression, over the morbid mass, or (from pressure on the main bronchus) over the side generally; or it may be of diffused or even tubular or hollow blowing type: these differences will depend on the precise relationships of the growth to the bronchial tubes and parietes; as will the absence or presence of bronchophony or pectoriloquy of the loud form. The heart's sounds are conveyed with undue intensity through the solid mass; and if this press on the aorta or pulmonary artery, there may be systolic murmur, simulating intra-cardiac murmur. Bronchial dry and moist rhonchi may be heard.

(f) The position of the heart and of the wings, or of either wing, of the diaphragm, will depend wholly on the direction in which the tumor grows: they may be considerably displaced, or retain their natural positions, even where a large mass occupies the mediastinum.

(g) But the most distinctive and striking symptoms of mediastinal tumors arise mechanically from their *compressive* and *perforative* influences; both kinds of action may be *centrifugal* or *centripetal*.

A special section (Part I. Section VIII.) has already been devoted to the description of Pressure-Signs, and to this I must refer the reader. It is, however, necessary to supplement what has been there said, by reminding the student that those signs may be variously, and as it were capriciously, combined according to the bulk and direction of growth of the mass.

(h) Pressure also acts *irritatively*, as well as *mechanically*, producing pleurisy, active hydrothorax, bronchitis, local pneumonia, and laryngo-tracheitis.

Centrifugal perforation of the chest-wall or spinal column, not unfrequent from aneurism, is rare from tumor: I have never known of an example, except where the growth was cancerous.

Centripetal perforation has in rare instances been observed in the lung, pulmonary artery, and œsophagus.

1512. *Symptoms* (a) *Local*.—The symptoms of mediastinal tumor are pain, very variable in amount; dyspnoea; cough, with or without sanguineous expectoration, of the jelly-like kind [1385], or catarrhal; actual hæmoptysis; inability to lie with the head low, and eventually complete orthopnoea, the sufferer sometimes,

for weeks before death, never daring to go to bed, and never enjoying more than fitful dozes. Or the patient may, when in bed, habitually lean forwards or sideways, with the head supported on the hand and the elbow bent, so as to throw the tumor off the trachea or main bronchus. Occasionally this awkward posture is assumed during sleep, the patient being unconscious of the change: * an instance of consensual action.

(b) *General*.—The constitution may long bear up against the local disease; but the dyspnoea and insomnia at length affect the appetite, and emaciation sets in. The patient dies gradually, anasarcaous and exhausted, or he may perish suddenly from obstruction or perforation of the pulmonary artery.

1513. *Diagnosis*.—An intra-thoracic tumor may, according to its seat, be confounded with extensive chronic pneumonia and chronic pleuritic effusion, with chronic pericardial effusion, great enlargement of the heart, or aneurism of the thoracic aorta. For the distinctive marks of the cardiac, pericardial, and arterial affections, I must venture, in order to avoid lengthy repetitions, to refer the student to the volume on the heart.

(a) Tumor will be distinguished from *simple exudative chronic pneumonia* by the tendency to increase, instead of decrease, of bulk of the affected side,—by the *implication of the mediastinal space*,—by the more serious change in the results of percussion,—the failure or the disappearance of vocal fremitus, which remains in chronic pneumonia,—and by the distinctive characters of the respiration in the two diseases. Notable hæmoptysis and red jelly-like expectoration never occur in chronic pneumonia; while, on the other hand, the emaciation is of earlier appearance, and more marked than in cases of tumor.

(b) From *pleural effusions* the difficulty of distinguishing tumor will not be great, if the case be an acute one, and if it either have been watched by himself from the first, or be laid before the physician with a well-established commemorative history.

Under the converse circumstances of chronic course and negative history the problem may still be easy of solution; or, on the other hand, it may be perplexing almost to hopelessness: all will depend on the *site* of the disease. Assuming, then, that the locality of an extensive toneless area of the chest-wall is such that the disease may *primâ facie* be empyema or tumor, the observer will have the subjoined more or less sure points of contrast to aid him in forming an opinion:—

* Holmes, F. C. H., *Females*, vol. viii., p. 120

EMPYEMA.	TUMOR.
Interspaces bulged; surface smooth.	Interspaces stretched, widened, flattened, surface uneven.
Enlargement of side uniform.	Enlargement of side may be irregular, limited prominence being added to general dilatation.
Edema of side common.	Edema of side relatively rare.
No external pressure results, such as enlarged subcutaneous veins.	Enlarged subcutaneous veins frequent.
Peripheral intercostal fluctuation occasionally present.	Always absent.
Perussion-note less disposed to tubular quality.	Perussion-note more disposed to tubular quality.
Limits of morbid resonance changeable by change of position of patient.	Such change impossible, or very limited in amount.
Morbid perussion-results localised in obedience to law of gravitation.	Careful perussion will almost surely detect some spot giving a comparatively normal pulmonary sound, where, according to the laws of physics, liquid, had this been the cause of the general defect in tone, must have made its way and hence caused dulness there as well as elsewhere.
Respiration distant and feeble, may be faintly blowing.	Respiration may be almost nil, but it may be intensely tubular or blowing.
Heart invariably displaced, and in proportion to the mass of fluid.	Heart may not be displaced at all, and rarely, if ever, chance to be displaced very notably.
Entire group of centripetal pressure-signs absent (435).	Centripetal signs in various proportions present.
Hæmoptysis and sanguineous jelly-like expectoration (766), never occur.	One or other or both, may be, or may have been, present.

And yet it must be confessed that though this looks on paper a satisfactory array enough, cases will occur in which absolute certainty is unattainable. I entertain no doubt that at the bed-side, in fixing on empyema as the disease before us, we sometimes turn out to be right, not on the grounds we assume, but simply on the doctrine of chances: empyema is common, tumor is rare.

Even the exploring needle will sometimes fail to settle the diagnosis,—for in cases of empyema, the point may not penetrate beyond old solid exudative material.

And there is a yet further difficulty which I have encountered at least six times. A patient having mediastinal tumor may also have empyema on the side most encroached on, generally the right. If the case be seen for the first time, when the two diseases are present, and if precise medical information as to the previous course of the complaint be wanting, this combination may be very difficult of diagnosis. But empyema does not produce centripetal pressure-signs,† nor give rise to hæmoptysis or jelly-like expecto-

* Caution is, however, requisite, in using this test.

† In a case of combined small tumor and effusion on the left side, seen with Dr. Scorrall in November, 1859, the diagnosis was made through the notable exten-

ration; if these symptoms be present, there must be, in addition to empyema, either tumor or aneurism. Besides, the test of movableness of dull sound may, with due caution, be appealed to.

1514. Given an intra-thoracic tumor, how may its *nature* be determined?

If the signs of infiltration of the lung co-exist, the tumor, as far as I have seen, is either composed of simple exudation-matter (of these I have examined three microscopically) or cancer. If the tumor present externally, it is cancer: if tumors exist elsewhere, either secondary to, or independent of, that in the chest, supposing even *their* nature cannot be established directly, the chances are strong, that the thoracic growth is cancerous. Violent hæmoptysis is more common with cancerous than other growths; expectoration of cancer can, of course, only occur with the former. The constitutional characters of cancerous disease may be wanting. But in the majority of cases it seems impossible to pronounce with surety as to the nature of the growth.

1515. *Treatment*.—Intra-thoracic tumor is, of course, beyond the permanent influence of treatment. Yet it is astonishing what marked temporary improvement of all the direct symptoms may be effected by cautious cupping, dry-cupping, flying blisters, profuse inunction with an ioduretted liniment, gentle purgation, and diuretics. I have twice known the diagnosis of intra-thoracic tumor contested, on the grounds of the relief produced by such measures; yet, *post-mortem* examinations, in one instance in three, in the other, in seven weeks, proved the existence of massy growths. Unfortunately all therapeutical means soon cease to avail us; and I know no more truly painful spectacle than that of the closing sufferings commonly inflicted by the combined mechanical and irritative effects of mediastinal tumors.

II.—MEDIASTINAL ABSCESS.

A.—ANTERIOR MEDIASTINUM.

1516. Abscess in the anterior mediastinum, a rare affection, is almost always of tuberculous nature,—and associated generally with strumous softening and abscess of the cervical glands.

1517. *Physical signs*.—The physical signs are, in nature, the of infra-clavicular tubular note across the sternum (for "horizontal conduction" could scarcely have carried it so far, had the note depended on partial condensation of the upper lobe through the pleuritic fluid below),—by aphonia, explicable only by traction of the recurrent nerve, and by the presence of a small independent nodule above the clavicle.

same as those of tumor; but in degree they differ. Inasmuch as fluids press equally in all directions, there will be proportionally less of the effects of centripetal pressure in the case of abscess than of tumor; the trachea, veins, and œsophagus will longer escape. The percussion-note will not be so seriously perverted from the standard of health: thus in the case of a man with suppurating cervical glands, and all the physical signs of non-pneumismal, solid, tumor behind the first bone of the sternum, the amount of dulness very perceptibly *decreased* during three months' observation previous to death.* Inexplicable during life, this change was accounted for by the purulent liquefaction of a portion of a tuberculous mass in the mediastinum: fluid would, of course, make its way from the sternal surface, backwards and sideways, in the direction of gravity, and permit the lung to come more forwards. It would, however, be a bold proceeding to diagnose liquefaction of a tumor on such evidence alone.

1518. *Symptoms*.—Suppurative action is generally very painful in this situation; irritation of the pleura and intercostal terminal twigs combines with the pain of the cellular or glandular inflammation to wear out the patient.

1519. *Treatment*.—Generous diet, cod-liver oil, occasional very moderate local depletion and counter-irritation are the therapeutical means indicated.

B.—POSTERIOR MEDIASTINUM.

1520. Abscess in the posterior mediastinum occurs sometimes from suppurative softening of bronchial glands; sometimes from tuberculous or other variety of caries of the dorsal spine.

1521. The clinical history of abscess resulting from softened bronchial glands has already been traced in outline (Section IV., 601).

1522. Some few years since I saw a very remarkable example of abscess and multiform disease in the posterior chest, which originated to all seeming in an injury to the spine caused by a fall from horseback.† The patient lingered for some years with changing physical signs and thoracic symptoms, sometimes apparently pointing to tuberculous disease, from which, at other times, the course of events seemed to prove him free. Ultimately he perished from degeneration of the kidneys with albuminous urine. On post-mortem examination, no trace of tubercle appeared. Both pleuræ adhered firmly in the region of the fourth, fifth, and sixth

* Bailey, V. C. H., *Males*, vol. ix. pp. 248, 310.

† Seen with Dr. Bosser, Harling, and Dr. A. Bree.

vertebræ, the lung-tissue breaking in the attempt to dislodge it; a portion of the right lung, larger than an orange, adjoining those vertebræ, dark in colour, softened and the seat of a cavity, communicated with a carious excavation in the body of one of them. These morbid appearances corresponded in position with an angular projection visible externally.* One of the most noteworthy facts in the clinical history of the case was, that the patient on one occasion expectorated a piece of bone of some size, evidently separated from one of the vertebræ.

* From notes taken by Dr. Harling.

PART III.

CHANGE OF CLIMATE.

Patulum Vitæ.

INTRODUCTION.

1523. Although we cannot at the present day subscribe unconditionally to the apophthegm "*pessimum ægro cœlum est, quod ægum fecit*," experience justifies us in placing among the most important agencies, for favourably modifying the course of various chronic diseases, migration from one climate to another; and further, experience likewise proves that, among chronic maladies so remediable, those of the lungs hold a very high rank.

1524. In changing climate, that is, the sum-total of the extrinsic physical conditions amidst which we breathe, we expose ourselves to new atmospheric, celestial, and telluric influences, varying in all conceivable varieties and modes of association from those to which we have been accustomed.

As far as concerns the atmosphere, the following are the essential phenomena subject to more or less wide variation in different climes: Temperature, absolute, as well as relative, from day to night, from day to day, and from month to month; habitual moisture; ordinary amount of dew; barometric pressure; mean quantity of rain, and mean period within which it falls; electrical states; proportion of ozone; mean amount of horizontal movement of the air; temporary violence of winds, or habitual windiness; specific quality in prevalent winds; amount of ordinary addition to the local air in the shape of mechanically irritant particles, such as smoke, of chemically irritant gases, or of volatilised poisonous organic matter.

In respect of celestial influences may be noted: Force and steadiness of insolation, as a calorific and vivifying agency; rela-

tive daily length of light and darkness; * chemical activity of the sun's rays; lunar influences; † and even those of asteroids. ‡

Among telluric influences, the chief are: The geological and mineral conditions of the soil: porosity and facility of absorbing rain and moisture; the qualities of the potable water; the presence or absence of ponds, marshes, trees; § the neighbourhood of the sea or of fresh water in the condition of lake, of tranquil stream, or foaming rapid; the amount of elevation above the sea-level; and the physical formation of the district, plane or undulating, open or confined, wide or narrow and gorge-like.

1525. Now, as all these conditions may be associated in endless variety of amount, activity, and manner of combination, it follows that little information of a kind practically applicable in the management of diseases can be expected from the examination of individual climates in regard of any one, or of any small number, of the more prominent of these characters. But in my mind the fact cannot be too strongly insisted on, though habitually ignored by writers, that there are influences of climate wholly beyond the range of meteorological investigation,—climates, in truth, of closely the same atmospheric characters produce effects very dissimilar on the human economy. We cannot, in other terms, announce *a priori* the influence which any one climate will exercise upon the inhabitant of another, though the meteorology of both regions be perfectly worked out according to the standard of existing physics. The physiological influence of all varieties of change of climate must be *observed* to be known and understood,—and *a fortiori* the influence of such changes in morbid states of the frame.¶ Now, information of this kind is exceedingly defi-

* The longest day in summer equals in London 16 h 34 m.,—in Palermo only 14 h. 46 m. But in winter the conditions are reversed—Palermo has a shortest day of 9 h. 27 m., while that of London is at an end in 7 h. 4 m. In other words, the winter sojourner in the Sicilian town would in the course of a month enjoy seventy-five hours more daylight than a dweller in London.

† The ~~use~~ superstitions, long prevalent concerning the influence of the moon on health and disease, seem to have produced a distaste for the serious investigation of the subject. Without referring to any special morbid effect, how can it be questioned that a different influence must be produced on animals exposed to lunar rays in London and at the Florida,—the Cuban moonlight being often literally brighter than our London sunlight?

‡ Laysan, "Med. Gazette," Dec. 1848.

§ The difference in the present and ancient climatic conditions of Provence, and the existing virulence of the Mistrail, are to a large extent justifiably referred to the cutting away of dense forests, that tempered the desolating blast of that wind.

¶ The degree to which the *a priori* system of argumentation has been pushed, in regard of the influence of climate, verges occasionally on the ludicrous. As an illustration of this, I may refer the reader to the disquisition on the relative merits of marine and inland residence in Richelini's work on the Climate of Nice (p. 180). In his ingenious appraisals of meteorology—too ingenious by half—everything is remembered, *except the patient*.

cient: with the exception of a few returns made out for Mâlemin, Menton, and Arcachon (to be by-and-by utilised), I know of no clinical observations, proving what effects commonly attend or follow the sojourn of the phthisical in various winter Sanitaris. It cannot, it appears to me, be too deeply regretted, that local practitioners employ their leisure hours in adding to the already too ponderous mass of meteorological and picturesque data concerning their various spots of residence, rather than in conscientiously jotting down in writing the exact conditions of their patients on arrival and on departure, and in due season submitting a series of such observations to collation and analysis. Until this work be done, and until this crying want be supplied, the attempts of the home-physician to fix upon the climate fittest for the various forms, degrees, and stages of phthisis, and for the idiosyncrasies of the phthisical sufferer, must obviously continue to result in disappointment much more frequently than needs be.

1526. Meanwhile, however, some few general inferences, capable of being practically utilised, may be derived from two sources. First, from the results of the examination of patients who have lived to return home: secondly, from a careful sifting of the statements made and testimonies given by writers and by travellers, healthy or invalid, medical, or non-medical. Of the difficulty of this task, simple as it may on first thought appear, no one can form an idea, who has not himself attempted it. For not only do different people view the same conditions in absolutely different manners,—not only are the effects produced by the same spot different in different people,—but interested motives, unreasoning prejudice, and professional passion have introduced themselves so largely into the discussion of all local climatic problems, that much, which has been put in print, is calculated to mystify, rather than to enlighten any one desirous of simply getting at the truth.

1527. Of these inferences the most important may, perhaps, be set down as follows:—

(a) There are few, if any, pulmonary affections which may not be either cured, suspended in their course, or relieved by the influence of judiciously selected climate. Those ill-defined conditions included under the vague title of “debility of chest,” may thus be completely and permanently removed,—as likewise the tendency to winter-attacks of bronchitis; chronic bronchitis in all its varieties, cirrhosis of the lung, asthma, emphysema, hay-fever, hooping-cough, and chronic pneumonia are always to be relieved,

occasionally to be cured,—and the disposition to recurring hæmoptysis effectually controlled.

(*b*) But pulmonary consumption? No climate will stamp out phthisis, wherever acquired, either in the individual or in the stock. To imagine that there exists a specific power in any combination of atmospheric conditions to stop the evolution of the local mischief and eradicate the tuberculous diathesis, is not a whit less illusory than the people's creed, which ascribes sovereign virtues to "native air." But climate may, and does, prolong the existence of the phthisical. It does this, either by modifying nutrition and vitality in the mass; or by lessening the activity, perhaps warding off the occurrence of, certain secondary states (say, bronchitis, hæmoptysis), which might of themselves have proved the real causes of death. In either fashion, climate takes its occasional share in bringing about the nearest approximations to real cure therapeutically obtainable. How many individuals may be pointed to in the divers sanatoria of South Europe, the prolongation of whose lives seems to hang on their clinging, winter after winter, to the spot in which they first experienced the change in symptoms, that signified the anatomical arrest of their disease! Doubtless, in many instances, the experiment of migration to a new clime painfully fails; but the failure depends either on inappropriateness, more or less absolute, of the spot selected; or, not uncommonly, on some individual specific proclivity to rapid downward course,—some idiosyncrasy that nullifies *ab origine* all intrinsic efforts at repair, and baffles all extrinsic plans for cure. Failures of the latter class are from the nature of things beyond our control; but those of the former may be lessened in number by prudence in the selection of climates.

(*c*) It is commonly held, the earlier the stage of tuberculous disease, and the shorter the time it has preyed on the organism, the more likely are good results to follow from judicious change of climate. I do not contest the general truth, but am desirous of insisting on the frequency of exceptions in both possible directions. On the one hand expatriation seems but to accelerate the fate of some sufferers in whom the disease has but just found a local nidus; while on the other, distinct arrest follows in others, whose lungs have for a more or less lengthened period been undergoing active disintegration. And in this indisputable fact lies a further illustration of the fallacy of the "curable stage" doctrine, as already insisted on [1317].

(*d*) Individuals, in whom the diathetic activity is either extinct or temporarily exhausted, and in whom the local anatomical

changes involve only a limited area, are *cæteris paribus*, the most favourable subjects for change of climate; but improvement need not be despaired of (sometimes occurs to the maximum amount) under the precisely opposite conditions.

(e) Grant that there exists an intrinsic disposition to chronicity of evolution, this will be fostered and intensified by favouring climatic conditions. In cases of this character real activity in the manifestations of the disease may be almost indefinitely warded off.

(f) Morbid states, extrinsic to the fundamental disease, whether these be secondary to the pulmonary tuberculation, or accidental and independent thereof—say, dyspepsia—often prove the real causes of the failure of climatic change.

(g) The effects of change of climate would often prove more or less abidingly beneficial, were they not weakened or nullified by the errors of patients themselves,—either by indiscretions of various kinds during their foreign sojourn, or by too precipitate flight from the balmy warmth of some southern clime, to the harsh cold of their own northern island.*

(h) The systemic suffering of tuberculous patients may in southern latitudes decrease greatly, and their strength improve, and their flesh increase, though the actual mischief be actively advancing. I have under such circumstances also known reparative changes take place in one lung whilst softening and excavation made rapid progress in the other. This somewhat paradoxical course of events is, however, not absolutely confined to patients placed under the sanative influence of an appropriate climate.

(i) In all conditions of phthisical disease (early and late, slight and grave) and in all varieties of climate, passing suspension or permanent arrest has occurred: in all conditions of phthisical disease (early and late, slight and grave) and in all varieties of climate, sustained activity of the disease, issuing in more or less rapid destruction, has occurred. Hence the inference, that there is something in the pathological idiosyncrasy of individual cases that dominates climatic influences, and according to its nature favours, weakens or nullifies these. But in this truth there only appears an illustration of the similar general doctrine in the therapeutics of phthisis, that I have deduced from facts and set down in a former place [1315, 5].

* I have known several instances in which acknowledged great improvement produced by the outward voyage, and by a stay in Victoria, has been utterly annulled by the return voyage home, in defiance of orders to the contrary, round Cape Horn and through the icebergs.

(j) In the selection of an appropriate climate absolute temperature is of much less consequence than the relationship the temperature of the new spot bears to that of the old. The same place will on the one hand produce or accelerate, or on the other hand cure or stay the progress of, consumption in individuals born in climates of opposite characters. Sojourn at Constantinople will every now and then materially benefit English consumptive patients; it proves confessedly destructive to phthisical Egyptians.*

(k) It is a grave mistake to suppose that a given climate cannot effect beneficial change in the condition of consumptive sufferers in other regions, because those born within it, themselves more or less frequently fall victims to phthisis. Probably the earth offers few known spots more favourable to the tuberculised British patient than Nubia. Yet the native Nubians on their own soil are occasionally destroyed by phthisis. Again, the climates of Australia, judiciously combined with those of Tasmania, very commonly prove serviceable to delicate Europeans, natives of northern latitudes; yet tuberculous disease is far from being unknown among the natives of Australia and of Tasmania sprung from British stock.† Or, keeping nearer home, while Southern Devon is a favourable resort in certain cases for phthisical Londoners, it seems a very hot bed of the disease for its own native population. Conversely who would think of submitting an English phthisical sufferer to the tender mercies of the climates of the Orkneys, Iceland or Siberia, and of yet more Arctic regions, even though he were repaid that, as is the fact, in those latitudes indigenous phthisis is but little known? And hence, profoundly interesting though this be, the study of the geographical distribution of disease and of the isopathic zones marked out by nature on the earth's surface,‡ does not lend the aid, that might possibly have been expected, in the selection of fitting climates for invalids of various kinds.

(l) In some of these favoured spots the natives become phthisi-

* Hottentot soldiers at the Cape suffer more from pulmonary disorders than white soldiers, so, too, at Sierra Leone, Blacks furnish a larger quota of chest-disease than white soldiers—in the ratio of 6.4 : 4.9 per 1000. — Vile Boulin, "Annales d'Hygiène," t. xli. Again, the "Army Medical Report" for 1859, states that when not a single white soldier was admitted for tuberculous disease in Jamaica, the phthisical deaths among the negroes stood at 8.97 per 1000 of the strength (Jackson, *Op. cit.* p. 591).

† Phthisis is, however, rare. It is stated by Dr. J. Beddie ("On Mortality in Australia and in England," p. 5) that "the mortality in the colony of Victoria, from all kinds of tubercular disease taken together, is less than that from phthisis alone in any county in England." It would seem, however, that the amount of phthisis is on the increase, at least in Melbourne [1862].

‡ For an interesting survey of the state of knowledge on this subject, vide Aitken, "Handbook of Medicine," p. 727.

cal, not through, but in spite of, the climatic influences under which they live. They neutralise these by the anti-hygienic conditions of their daily lives. The aboriginal stock at Malaga is destroyed to a certain extent by phthisis, as a probable consequence of the excessive insalubrity of the town;—the imported Australian stock, because their habits of life are gradually becoming assimilated to those of their ancestors in the spots from which these originally emigrated.

(m) Extreme climates, as a rule, exercise an unfavourable influence on the course of the disease. Extreme *cold* promotes internal congestion, and gives activity to the local secondary mischiefs: not invariably, however, for I have known the dry cold of Canada, Minnesota, and even Sweden borne with, when *sudden* exposure to the outer air was carefully avoided; but here the air is still. Extreme *heat* exercises an unquestionable and yet worse influence on the diathesis, and in inter-tropical countries there is commonly a tendency to neuteness of outbreak and rapidity of course.*

(n) Mere change of climate is *per se* beneficial, provided there be no absolutely noxious quality in the meteorology of the new region sought.

(o) *A fortiori* moderately frequent change from place to place is more efficacious therapeutically, than prolonged sojourn at any one spot, although the climatic characters of this be markedly salubrious.

(p) Effects of a distinctly favourable kind may follow immediately a new climate is reached, be maintained for a while, then disappear,—the disease reasserting its former supremacy: the good results may sometimes be reproduced by removal to a fresh spot allied in characters to the first one.

(q) Theoretically speaking, steadiness of temperature from day to day, with but slight nocturnal fall of the thermometer, ranks as a very important condition; but practically it turns out to be comparatively insignificant. For those climes, Egypt and Australia, which furnish from time to time the most striking examples of arrest of phthisis in individuals of the Saxon and Celtic races of North Europe, are glaringly deficient in this element of theoretical success.

* Ruzé, La Phthisie à la Martinique, *Mém. Acad. de Méd.*, t. x, 1813. A very large body of evidence proving the baneful influence (even in places where the natives suffer little from the disease) has been collected by Rochard. *Mém. de l'Acad. de Médecine*, t. xx, p. 196. 1856.

(r) The emotional influence of climate contributes to its beneficial or baneful effects on the physical state of the system more actively than is imagined. But the nature of that influence cannot be predicted in any individual case. I have known natives of the Canary Isles, and English people long domiciled in the East or West Indies, charmed with the sunless gloom of London.* How long such deficiency of light might continue to prove exhilarating, would probably depend in each individual on the amount of temperament that finds joy in variety.

(s) Next in importance to genial-warmth stands, as matter of experience, the dry and bracing, or *per contra* the moist and sedative quality of climate.

(t) In the selection of a locality, dominantly of one or other of these qualities, the anatomical conditions, state of progress and presumed intimate nature of the existing affection, are less faithful guides, than the excess of the *strictum* or the *laxum* in the organism generally, and the instinctive partiality of the individual in one or the other direction.

(u) In the choice of a fitting climate we are always embarrassed at the threshold by the conflicting characters of various elements of the disease. On the one hand the diathetic vice calls for a stimulant and invigorating atmosphere; while, on the other, in the soft, soothing, but enervating air of a moist and sedative clime resides not only the best safeguard against laryngeal, bronchial and pulmonary irritation, but also an aid of no mean power in controlling the general disposition to sub-inflammatory and ulcerative action inherent in the disease. Besides, there is the further difficulty, that the successful control of one group of the elements of the disease by climate-influence may actually rouse into activity some other group, previously quiescent or even dormant. A locality, for instance, which soothes the irritability of the bronchial surface successfully, may give fresh vigour to the diathesis.

(v) That no theory, which has ever yet been advanced of the intimate nature of tuberculisation, furnishes a trustworthy guide in accepting one climate, rejecting a second, and hesitating about another as a doubtful *tertium quid*, is sufficiently proved by the fact that all climates, which ought on the orthodox theory of the hour to have agreed, have disagreed, and all climates which ought to have disagreed, have agreed.

* Sir J. Herschel found by the actinometer that the force of sunshine equaled 48°·75 at the Cape of Good Hope, while ordinary good sunshine in England makes no higher than 25° to 30° - Athenæum, April, 1835.

(*π*) Places subject to wind,—whether this declare itself in excessive habitual windiness, as in certain parts of New Zealand,* or in violent occasional wind without specific properties,—or in wind having specific properties, as the Mistral, the Bise, the Gregale, the Simoom, the Sirocco, or the Harmattan,—are either altogether unfit for the residence of pulmonary invalids, or can only be resorted to at seasons when those winds do not prevail, or in limited districts, where natural or artificial protection is obtainable.

(*ρ*) Whatever be the difference of opinion as to the influence of high or low barometric pressure as an enduring state, there can be no doubt that regions characterised by rapid alternations in the weight of the atmosphere, are unfit for pulmonary sufferers.

(*γ*) But the difference of opinion referred to is at the present day scarcely justifiable. For, on the one hand, evidence seems to have been collected, as already shown [1302, *δ*], calculated to prove that the sum-total of conditions, existing in the atmosphere of elevated regions, antagonises the deposition of pulmonary tubercle. And, on the other hand, where spots on, or scarcely more elevated than, the sea-level, exhibit any particular immunity, specific super-added conditions, themselves antagonistic to tuberculation, may be traced in the climate.

(*ε*) One of these conditions seems to be either actual malaria, or the physico-chemical combination conducive to malaria. The apparently well established antagonism of ague and phthisis has already been referred to [1282, *c*]; and illustrations of the probable efficacy of malarial districts in directly controlling the progress of tuberculous disease will be found elsewhere [1607]. But dampness of soil seems *per se*, deeply injurious.†

(*αα*) The relative salubrity of inland and marine atmosphere became a moot point as early as the days of Aræteus, and still remains undetermined. The question is plainly a very complex one, for difference of food, of occupation, of mode of life, might have as much to do with any excess of proclivity to phthisis exhibited by dwellers either in the interior or on the sea-coast, as the difference of the atmosphere they breathed.

(1) Theoretically, the alleged greater proportion of oxygen in sea-air, and its impregnation with iodine and bromine, have been set down as likely causes of its superior fitness for phthisical

* Dieffenbach reports that in New Zealand there are scarcely more than twelve calm days in the year — *Travels in New Zealand*, Lond. 1843. Wellington appears to be the greatest sufferer in this way.

† G. Buchanan, M.D., *Rep. Med. Off. Privy Council*, 1866-7.

sufferers. On the other hand, disbelievers in that fitness, maintain the saline impregnation of the air must be irritant to the bronchi, and *pro tanto* injurious.*

(2) The faith of Laennec in the curative influence of sea-air (mainly founded on the rarity of phthisis on the coast of Brittany), was so unbounded, that he actually strove by means of fresh sea-weed to maintain a marine atmosphere in his Paris wards. Verhaeghe,† arguing on the same side, shows that, while the deaths from phthisis in the interior of the country amounted to 19 per 100, they fell to 6·60 per 100 in the civil hospital at Ostend, and to 4·6 among sailors. This observer, however, appears to lay more stress on the fish food and the open-air occupation on the sea-shore, than on the quality of the atmosphere. Again, it might be urged, unless there be some substantial superiority in sea-air, how comes it that the vast majority of winter resorts for the phthisical are seated on the sea-board?

But, on the other hand, that Laennec overrated the sanative influence of marine air, cannot at the present day be contested for a moment. In islands so small that their inhabitants may be said to live, as it were, in a ship perpetually at anchor, natives and strangers alike die of phthisis: take, for example, the Scilly Islands. Long ago, Fodéré maintained, on the ground of experience, that marine air both favoured the development of phthisis, and acted injuriously on those already affected.‡ Mühlry, too, finds strong support for the doctrine of the preventive influence of low barometric pressure on the development of phthisis in the fact, that, on the sea-shore, where that pressure must be at its maximum, the proportion of tuberculous disease is greatest.§ As to the comparative immunity of sailors, the alleged fact is absolutely and with justness denied by Rochard [1615]. And, in respect of the sea-board phthisical resorts, it seems probable in the first place that their abundant adoption has arisen from circumstances independent of their proximity to the shore; while it is certain, in the second place, that some of the most trustworthy sanatoria lie inland,—as Clifton, Pau, Le Canet, Hyères, Pisa, Rome, Upper Egypt, Nubia, the South and North African Deserts, and above all the lofty valleys of the Andes.

(3) On the whole, the weight of evidence seems to bear rather against, than in favour of, marine air, *where it is obtainable*,—that

* Requin, *Gaz. Méd. de Paris*, No. 11, 1834.

† *Syd. Soc. Year Book*, p. 222. 1859.

‡ *Médecine Légale*, Paris, 1813.

§ *Klimatologische Untersuchungen*, 1858.

is on the sea shore. But as its influence under these circumstances cannot be separated from the antagonistic evils of high barometric pressure and dampness of soil, the real character of that influence is likely long to remain one of Nature's secrets. Suppose the air of the valleys of the Cordilleras were impregnated with marine exhalations, would it be more, would it be less, beneficial than it actually proves? There is the theoretical problem to be solved.*

(bb) The quality of the food obtainable in any proposed place of abode is a matter of essential importance. Defect in this point of view will, especially in some persons, more than counterbalance any advantage derived from superiority of climate.

(cc) The peptic qualities of an atmosphere—those that stimulate appetite and promote primary digestion—are a matter of grave consideration. The climate which will, in any given case, prove most effectual in this aspect cannot be announced *à priori*: the appetite may be much more stimulated by the atmosphere of Pau and Torquay than by that of Nice and Malaga.

(dd) Climates vary in their influence on the temper, both indirectly through the improvement or the reverse they produce on the existing disease, and directly by some mysterious working in the system, appreciable but unintelligible. Physical mischief will scarcely be repaired in a climate that renders the temper morose and irritable. Hence the supply of agreeable means of recreation is not to be considered a matter of indifference.

(ee) The disposition to like, or the determination to find fault with, all that is novel, are elements of character that modify more seriously, than might be supposed, the influence of climatic change. "Yes," said a patient, arguing on the question of (as it proved, a final winter in Madeira, "I know I go there to die,—but to die amid the glories of beautiful nature, cradled in an atmosphere as balmy, as redolent of flowers, as its sun is gorgeous. Here too I should die, —but die cribbed and confined in a room, narrow as sunless, —smoky, foggy, cheerless." Evidently if a foreign climate could be beneficial, it would be so in the case of a sufferer thus predetermined to enjoy it. At the opposite point of the compass appear those refined representatives of Byron's valet Fletcher, who, thorough John Bull in spirit, tortured the poet with his "perpetual lamentations after beef and beer,"—people who travel from Dan to Beersheba, and find that all is barren. Patients of this class should never leave their own firesides.

* An elevation of even fifty feet above the sea level, as may be felt at certain parts of the Underhill, greatly weakens the strength of marine vapour gusts.

(ff) The precise object with which a patient is sent abroad, or rather the nature of the hopes, we feel justified in holding out from the influence of a new climate, furnishes in a certain sense the grounds of its selection. The soft skies of the Azores or of Madeira offer an unobjectionable clime, where our expectations soar no higher than to see the sufferer gently lulled, while he falls into his last sleep; but we may expose him without misgiving to the discomforts of a South African or Australian voyage, where a hope of arresting the disease yet remains.

(gg) And, finally, idiosyncrasy of healthy temperament, oft-times giving allied idiosyncrasy in disease, must never be neglected as a guiding element. If, for instance, the instinctive preference of the individual be for cold,—if he be of the type of the sturdy Saxon, who would in health find delight in a winter promenade from one end to the other of Siberia, dressed in nankeen,* he might, when tuberculised, be trusted to the ferocious winter of an Alpine solitude with infinitely less chance of evil result, than the man who in health found his enjoyment in the enervating softness of a sunny and genial warmth.

* A feat actually performed, as is well known, by Captain J. D. Cochrane, R. N. Vide his "Narrative of a Pedestrian Journey through Russia and Siberian Tartary, from the Frontiers of China to the Frozen Sea and Kamchatka." 1824.

CHAPTER I.

LAND CLIMATES.

1528. An invalid, condemned to winter away from his own hearth, will instinctively divide climates *in limine* into home and foreign. His likings and the nature of his ties, rather than the medical fitness of things, will guide him at once to a choice. But some general grounds of preference on either side might be placed before him in this wise. He might be told that in all English places of resort he must be prepared for a mean temperature very little superior to that of London; for almost abiding gloom of sky; for windiness more or less constant and violent; for, practically speaking, a protracted adieu to almost all the enjoyments of out-of-door life; for total absence of the charm of active and fragrant vegetation in the surrounding country; for short, foggy, often sunless days; and, lastly, for the deficiency of those novel scenes and those bright, gay, and animated groupings of the population around him, that give interest to the streets and roads of continental sanatoria. But he might be reminded, *per contra*, that on his own soil he will find good, really nourishing food and familiar domestic comfort; that, if he walks, his sense of decency will not be offended, and he will run no risk of being blinded by dust; that mosquitoes are a thing unknown; that he will escape the oftentimes distressing glare of an over-brilliant sunlight; that he may every now and then stumble upon a lovely day, the rich charm of which proves all the greater, because it is so very, very rare; that he will escape that form of atmospheric infliction, far from uncommonly experienced even on both Rivières, in which, while a fierce sun well-nigh scorches one side of the frame, an icy mountain-blast freezes the other;* that he will linger within reach of home associations, and of the kith and kin he cares for;

* See in Illustration the clever, though somewhat overstrained, *jeu d'esprit*, "La Ville de bon Repos, par le Dr. Claron, Née, 1868." The author's *ville de plume* gives nothing abundant of the spirit in which he writes; nevertheless his amusing satire would offer a most desirable study for any enthusiast regarding the Mediterranean shores with the fond expectation of twining them with a climatic cypress.

that he will be saved from the annoyance of that unsleeping, ever-active cupidity, which strives to wring from him twelve months' pay for six months' supply; and that he will never know that pain of feeling himself a sort of tolerated being, which even the domesticated resident in a foreign land is sure from time to time to have forced upon him.

1529. Appropriate climates for summer and autumn are to be found in all European countries in abundance. Those adapted to winter and spring need only be considered in this volume; and it may be observed that the fitful inclemency of spring is found to be infinitely more difficult to legislate for, than the steady rigour of winter.

WINTER AND SPRING CLIMATES.

1530. These climates may be classified as follows:—

GROUP I.—SEDATIVE CLIMATES.

GROUP II.—STIMULANT CLIMATES.

GROUP III.—CLIMATES HAVING AN ATMOSPHERE ADVENTITIOUSLY IMPREGNATED.

GROUP IV.—CLIMATES DERIVING SPECIAL CHARACTERS FROM THEIR ALTITUDE ABOVE THE SEA-LEVEL.

1531. It is proposed now to place before the practitioner such an outline of the leading characters of the main localities belonging to each of these groups, as will guide him to a choice in any particular case.

GROUP I.—SEDATIVE CLIMATES.

1532. Climates appertaining to this group are generally distinguished by humidity and soft, soothing geniality. Their favourable influence on the system is anti-irritative and anti-febrile; they weaken the activity of oxidising processes, and promote fat-formation. In their exaggerated and evil influences they prove more or less relaxing, depressing, atonifying, and enervating; they lower the animal spirits, weaken the energy of healthy function, and promote flux.

Lehmann insists, on chemico-physiological grounds, on the importance of moisture, and believes we may possibly benefit phthisical patients by making them breathe a moist warm air, as much as by giving them cod-liver oil and other medicines.* Chemistry evidently holds itself incognizant of clinical dissimilarities.

* *Physiol. Chemistry*, by Day, vol. iii. p. 382.

1533. Climates of this class are consequently suitable, where the main disease is of the irritative, pyrexial type,—the cough, more or less dry,—the voice husky,—the throat readily disposed to inflame,—the lungs prone to active congestion and hæmorrhage;—especially where all this is combined with general restlessness, nervous crethism, absence or slight amount of perspiration, and unquiet, deficient sleep.

1534. In this group are found the following sub-groups:

I. British Isles	Sidmouth; Torquay; Penzance; Cove, Jersey.
II. France	Pau.
III. Spain	Valencia; Cadiz; San Lucar.
IV. Italy	Pisa; Rome; Venice.
V. Greece	Patras
VI. Mediterranean Islands	Sicily (Palermo); Corsica (Ajaccio), Corfu; Zante.
VII. Eastern Atlantic	Madeira, Azores.
VIII. North America	Florida
IX. Western Atlantic	Bermudas; Bahamas
X. West Indies	
XI. Virgin Islands	

L. BRITISH SUB-GROUP.

1535. *Sidmouth*.—Remarkably soft, and sensationally as warm as, though thermometrically somewhat cooler than, Torquay; sheltered to an unusual degree from all winds except the southerly, yet stormy enough in the spring; sufficiently mild to be the *habitat* in winter of many delicate plants, Sidmouth fails to attract on account of its monotonous dulness, but seems to me climatically entitled to give asylum to a larger share of the consumptive population than ever resort to it.

1536. *Torquay*.—The air of Torquay* is drier than that of places on the south-western coast generally, and especially of Penzance; the mean winter temperature ranges high for England (about 44°); the rain-fall is not excessive; fogs are very rare; the scenery is beautiful; the town cheerful; different mean amounts of warmth are obtainable at different levels; and the spot possesses, for its temperature, the soothing and sedative qualities in a high degree. When, as will happen, a run of leaden-skied days occurs, the patient's spirits flag,—and then, more even than usual, the hepatic system is prone to become disordered. But, on the whole, Torquay excels in many, and equals in most, points, the majority of the sanitarium of the same class abroad.

* C. B. Hall, "Torquay in its Medical Aspects, 1857" A thoroughly complete monograph.

1537. *Penzance*.—In Penzance we have a humid climate, absolutely speaking, only a shade warmer, in the winter, than Torquay, but of greatly more equable warmth, the night-fall in the thermometer being at a minimum. The winter may be called steady, the spring capriciously changeable,—the rain-fall high, the number of rainy days very considerable (averaging 90 for the winter and spring); wind is frequent,—the skies variable, but often for days together bright and almost cloudless. There is less to interest the invalid than at Torquay; but there is no absolute lack of quiet amusement.

1538. *Queenstown (or Cove)*.—Fairly well sheltered from cold winds, Cove enjoys a slightly higher mean temperature, and a notably lower extreme range of this, and is less rainy, than the Devonian and Cornish towns. The air is uniformly soft and balmy, sometimes singularly so; equableness of temperature is the rule; sudden changes are comparatively rare, and little doubt can, I think, be entertained that, in a purely climatic aspect, Queenstown is the most desirable spot in these islands belonging to the present group. The dampness is, however, extreme; hence, while the vegetation is extremely luxuriant, the tissues of healthy strangers grow soft and flabby, and fat tends to accumulate.

1539. *Jersey (St. Heliers or St. Aubin)*.—Here the winter is short; snow almost unknown;* the temperature much the same, with a brighter sky, as that of Torquay, and, as a rule, equable, with occasional days of extreme mildness,—the atmosphere scarcely ever still, and the north-east wind commonly violent in spring.

II. FRENCH SUB-GROUP.

1539.* *Pau*.†—The only French resort of importance belonging to the sedative class, Pau, has become a quasi-English colony. In point of temperature, such small superiority, as it may possess, is distinctly limited to the spring,—the thermometer ranging on an average in the winter from 2 to 3 degrees lower than at Torquay and Cove. The cold of winter, however, affects the system less sharply in consequence of that habitual stillness of the air, which (though I have witnessed a perfect hurricane in September, of two

* In the exceptional winter of 1870-71, snow, a foot deep, lay on the ground.

† Sir A. Taylor, M.D., "The Climate of Pau," 3rd edit. — a book to which much of the English popularity of Pau may fairly be traced.

days' duration, is one of the most striking characteristics of the climate. When wind does blow, it is habitually free from keenness. The force of the sun's rays is considerable, often obliging even the peasantry to use an umbrella. The amount of moisture in the air is very considerable,—constantly marking 80, 82, and even 85 in the scale of 100 deg. Rain falls plentifully; but both ground and air dry much more rapidly than in England. Snow, as a rule, is seen to a moderate amount only, but sometimes remains on the roofs for days together. The plague of mosquitoes is unknown.

The influence of the air on healthy strangers is singularly depressing, and the *nonchalant* indolence of the native population often astonishes, while it amuses, the British visitor. But the influence in diseased states, fitted, as it were, to and by the climate, may be precisely the reverse: I have seen a patient, who had been wretchedly depressed at Cannes, luxuriate in exuberant spirits at Pau. Escape from the spot is easy, when found not to agree:—Argetès-de-Bigorre would probably suit many, to whom the banks of the Gave prove too sedative. The abundance of easily attainable summer resorts, both mountain and seaside, is an important feature in the medical topography of Pau.

As far as my observation goes, Pau will rarely achieve anything very wonderful in the way of curative influence; but it will yet more rarely give rise to those grave disappointments common in the instance of climates of more pronounced character. The climate scarcely benefits the local and intercurrent inflammatory mischiefs of phthisis, but appears every now and then to keep the diathesis in check.

III.—SPANISH SUB GROUP.

1540. *Valencia*.^{*} Seated amid groves of palms and orange-trees, at a very short distance from the sea, on alluvial soil singularly damp-retaining and luxuriantly fertile, surrounded with copiously irrigated and malarial rice-grounds, and provided with a large lake on its southern aspect, Valencia, with a temperature averaging nearly 50° in the winter months,† is probably one of the

^{*} Cassinier. "Le Climat de l'Espagne, 1828." An interesting and conscientiously executed monograph.

[†] A fully patient, who stayed at Valencia from 19th of November to the following May, "never came out by fire." Had a cold and rheumatism every now and then, but in February 1871, I learn from Mr. Port, H. B. M. Consul, that "although their thermometer marked 32, each of 23 patients then experienced an 1821

warmest, most humid, and depressing spots in continental Europe. Rain is in nowise the cause of this humidity; the mean fall is limited, and the number of rainy days small. Snow is almost unknown. The sirocco, and still more the due south wind, exercises a singularly enervating influence even on the inhabitants. The potable water is bad.

Valencia is but little sought by English sufferers; yet in cases of highly irritative phthisis, and where there is a disposition to recurring active hæmoptysis, where, in a word, markedly sedative climatic influence seemed desirable, it might fairly be tried. The malarial quality of the air offers no valid objection to the experiment [1282, c].

1541. *Cadiz*.—Charmingly seated on an almost insular site, "a promontory of rock formed out of concreted shells running far out into the sea, and varying in height from three to seventeen yards;"* moderately humid, soft, and depressing in the main; enjoying a mean temperature in winter of 53°, and in spring of 60°, with a low mean diurnal range of about 10°; though changeable, and subject to visitations of the sirocco, and occasionally chilled by very dry and cold north winds, Cadiz, taken fair rank among available climates of this group.

1542. *San Lucar*, within two hours of, and warmer than, Cadiz, built on a dry sandy soil at the mouth of the Guadalquivir, and protected by hills, enjoys high repute among local physicians as a resort for the phthisical. Its dryness almost removes it from the class to which Cadiz belongs.

IV.—ITALIAN SUBGROUP.

1543. *Pisa*.—Seated on an alluvial plain at the mouth of the last valley of the Arno, Pisa, fully exposed to the south, is tolerably well protected to the north and east by hills and mountains rising, at about seven or eight miles' distance, to the height of 3000 feet. The loftiness of the walls, surrounding the town, probably contributes to the stillness of atmosphere that often reigns within it.

Precise meteorological data concerning Pisa, as Charriera† regretfully notes, are almost completely wanting. But there is no danger of error in affirming that Pisa possesses a markedly humid,

* Francis, "Change of Climate," p. 145, 1853. A valuable contribution, to which the existing knowledge of Peninsular climates is mainly due.

† "Le Climat de l'Italie," p. 411.

warm, and relaxing climate. The mean winter temperature has been set down as 44° , that of spring as 57° ; the rainfall is very abundant: Alfieri in his sonnets, and many other Italian writers, inveigh against the perpetual raininess. The winds, which play on Pisa are all more or less loaded with moisture; large tracts of marsh lie in different directions around the town.

Pisa, once a city of considerable commercial importance, ranked formerly as the chief destination of expatriated British consumptives. Its prosperity has long been a thing of the past; its once-populous and busy streets are now empty and silent. So, too, it has so completely lost its *quondam* prestige as a sanitarium, that its very existence is scarcely thought of by physician or patient, when a place for winter sojourn is under consideration. The cause of its social decay does not concern us here; but as regards its climatic neglect (while I scarcely dare, with the late Dr. J. Johnson,* uphold Pisa as "one of the *best* asylums for an invalid of which Italy can boast"), I entertain no particle of doubt that the changed opinion is the result of sheer medical caprice. For Pisa contains in a high degree the main qualities suited to the early stages of irritative and pyrexial phthisis. In the advanced and colliquative conditions of the disease, it is of course in the last degree, theoretically speaking, to be shunned.

The saddened grandeur of the silent streets, the placid calm of life within them, would form an attraction to certain invalids as weary in spirit as in body. He who had fought the battle of life and been worsted, he who in the hurly-burly of cities had failed "to secure himself a place in the Sun,"† would find a charm in the soothing repose of Pisa. For persons of naturally melancholic temperament, it would, as surely, prove singularly inappropriate.

I have difficulty in believing that the climate can, *as a rule*, promote hæmoptysis; though I cannot, of course, discredit Carrière's statement, that the symptom sometimes follows shortly after arrival at Pisa.‡ The same writer, whose judgment of the climate has contributed greatly to depopularise the once-favourite Tuscan town, makes what may be called dramatic capital for his argument, in a really touching narrative of the death within its walls of the

* "Change of Air." London, 1852. A book abounding in evidences of that quaint singleness of thought and action for which its author was distinguished.

† A happy phrase of Jules Sandeau. See *Marianne*, i. 11.

‡ *Op. cit.*, p. 422.

royal sculptress, the Princess Mary of Orleans; but the medical significance of the tale is lost by the admission that, when the patient left her Paris home, the hour of possible relief had already passed.

1544. *Rome*.—The thermometer gives a mean temperature, both in winter and in spring, some few degrees higher at Rome than at Torquay and Cove. But the frequent and abrupt alternations from the tepid, exhausting sirocco to the bitter, piercing Tramontana counterbalance all the good derivable from the higher average. Rome is exposed to all the winds of heaven; snow sometimes falls abundantly; a skating-season of several days' duration is a form of enjoyment not unknown; the rain-fall is considerable, and inundations of the Tiber of intense fetidness occasionally oblige the inhabitants to transact the business of life in boats. The temptation of the ice-cold galleries, added to the stupendous filth of the streets and byways,* further colour a picture which cannot be called hygienically attractive. I know it is perfectly true that occasionally a series of days will occur in succession to the last degree delightful—balmy, soft, and soothing (like all the world, I have felt such in mid-winter), but I know, too, that in the long run the cold often proves more trying to people born in northern latitudes, than that experienced in their own homes.

Besides, it has been shown that the French invading soldiery, arriving in Rome in perfect health, perished in larger proportion of phthisis than their comrades remaining at home.†

1545. *Venice*.—Although Venice takes rank with mild, soft, and equable climates,—though its atmosphere be demonstrably impregnated to a large extent with iodine and bromine,—though the town be free from the malarial and zymotic diseases which the nature of its site and the habits of its population would

* Delicate English people of the most refined ideas and habits are sent to Rome, in order that they may reap benefit under its reputed sunny skies, and from its fabled softly equable temperature. But it is forgotten that they are at the same moment condemned to the revolting spectacle of, and poisonous exhalations from, nameless abominations in their daily walks through the most frequented and the most interesting parts of the town. I remember well, after visiting one of the spots which (if correctly named) should by its associations rank among the most hallowed in the Eternal City—the house of Rienzi, “last of Romans”—being forced to return home at once, from the sickness brought on by the intolerable odours. Can health be found in an atmosphere so mephitic? It may not be irrelevant to express a hope that the new political order of things (Autumn, 1870) may look after laurels in the way of hygienics and public decency more effectively than its predecessor.

† Jacquot, “Hist. Méd. du Corps d’Occupation des Etats Romains,” *Gaz. Méd. de Paris*, 1854.

a priori lead us to expect,—though there are some spots of *terra firma*, and some houses on the canals, on which a bright sun habitually sheds warmth for a portion of the winter's day,—though the sleepy, gliding movement of the gondola affords a delicious form of passive exercise for the weak and weary,—and though this “sea Cybele” be invested with an indefinable charm, historical, architectural, and topographical, that cannot fail to soften the misery of the invalid, who sojourns on one of its noiseless thoroughfares, still it is difficult to imagine Carrière* can be right in asserting that Venice is “one of the best climates in the first stage of consumption.” For here the average winter temperature ranges as low as 38° Fah., or 6° lower than Torquay; snow falls on five and a half days annually; damp, noisome exhalations are being perpetually evolved from the lagoons and canals, and especially from that narrow strip of putrified animal and vegetable detritus, exposed over an aggregate surface of millions of feet above the water-level, when this sinks with the tide's slight ebb; the whole district is exposed to cutting blasts, especially from the N.E.; and artificial means of obtaining warmth in the houses are almost, if not wholly, unattainable.† I confess the evidence of a high per-centage of recoveries, more or less complete, or at least that of an imposing mass of cases, in which a *status in quo* was maintained during a Venetian winter, would alone make me a convert to the apparently paradoxical opinion of the learned climatologist.‡

V.—GREECE.

1545.* *Patras*.—Information concerning the meteorology of the mainland of Greece is so limited, that the following Table, most kindly furnished me by a resident,§ from his observations for the autumn, winter, and spring, 1870-71, is printed *in extenso*:—

* “Le Climat de l'Italie,” p. 465. Incomparably the most elaborate and philosophical history of Italian climates in their physical relations ever published, — a production that soars high above mere commentaries on meteorological tables. But medically considered, it seems scarcely free from cretulinness of opinion.

† “Venetian Life,” by W. D. Howell, p. 36, a book rather to be recommended for the preciseness of its domestic details than on any other score.

‡ Phthisis is certainly rare in Venice; Oliva asserted that it only furnished 7 or 8 of the 1200 patients annually admitted into the hospital (Bull. de l'Acad. de Med., t. ix, p. 173).

§ Rev. Herbert A. Boys.

	Sept 13 to 30	October	November	December	January.	February.	March	April (emitting) 12-24	May.	June 1-24
Total rainfall	43	1.93	1.73	7.97	7.26	2.05	1.38	.04	.16	41
No. of rainy days	2	8	6	22	18	8	7	3	3	1
Max. fall in one day	33	66	46	1.41	96	74	44	.02	.08	41
Greatest max. temperature .		80	75	70	64	62	76	78	88	91
Least max. temperature . .		66	58	54	49	47	49	62	70	77
Average max. temperature .			68.3	60.3	57.1	56.3	61.7	71	76.9	83
Greatest min. temperature .		69	59	50	40	49	58	57	69.5	67
Least min. temperature . .		46	40	35	32	30	30	43	47	58
Average min. temperature .			49	44	40.2	40.6	44.2	51.3	56.8	63

My informant observes that this autumn was unusually dry and warm, according to popular report; winter, unusually wet and warm; early spring, dry and warm; later spring, rather cool than otherwise. Winter appears to come suddenly: "from November 27 to December 4 gave all the difference between the best English September and the worst October."

Snow occasionally remains a week on hills, close to Patras, not more than 500 feet high; but, during the winter of 1870-71, any that fell lower than 4000 feet had very soon disappeared again. So mountainous is the country that the horizon presents a very nearly continuous snow-line. In early spring the N.E. winds from these snowy ranges prove very trying.

Though the atmosphere is very clear, the Cephallonian mountains, 60 miles off, being distinctly visible, it is heavy; and Patras seems a very relaxing place.* To quote the *ipassima verba* of my correspondent: "The town stands on a narrow strip of gently sloping ground, close to the sea, and on either side are similar sloping plains now devoted to currants, but which in former years

* The air of Athens seems, on the contrary, to be dry and bracing.

were marshes, which developed fevers and ague,—so that when Venice ruled the Morea,

Venice : Patras : : England : Sierra Leone.

Objectionable citizens were appointed to Patras offices, and generally conveyed their bad qualities to the cemetery in no long time." Ague is still prevalent.

Fires are not used by the natives, and scarcely by strangers,—and catarrhal affections appear to be severe. Hotel accommodation is deficient.

The climate of Patras seems, on the whole, to bear a strong affinity to that of Valencia; it has agreed with the invalid, to whom I am indebted for this account of its meteorology. Just behind the town is a flat-topped hill, some 250 feet high, which would form a much healthier site than Patras itself.

The country abounds, besides, in spots at various altitudes, to 6000 feet above the sea-level, some of which might be utilized for summer residences.

VI.—MEDITERRANEAN ISLANDS SUB-GROUP.

1540. *Palermo*.—Dampier than Venice, Rome, and Madeira,* enjoying a mean winter temperature of 53° Fah. (nearly 12 degrees higher than Pau, and 4 than Menton), Palermo exhibits greater thermometric change from day to night than Penzance. The annual number of rainy days (131) is very considerable,—the quantity of rain not proportionally great: the rain is therefore, in the main, of the drizzling kind.† Fog is excessively rare; but the evening dews are habitually heavy. Snow falls on two or three days, one year with another. Ice is almost unknown; thirty years might elapse without its being seen. The exposure of Palermo places it at the mercy of northern and north-western winds,—and a tempered form of the mistral is not absolutely unknown: the town is, besides, a greater sufferer from the sirocco (often lasting three, rarely more, days) than any other spot in Sicily, and even than Malta.

The main thoroughfares of Palermo are clean; the town is provided with a beautiful marine promenade; the sources of amuse-

* Vivienot, "Das Klima von Palermo," p. 68. Probably the most minutely precise monograph on a single climate in existence.

† I hold it on unquestionable authority, that rain will occasionally fall more or less every day for six weeks at a time in winter.

ment fitted for invalids, as well as those for their healthy companions, are numerous (the wearing *ennui* of many of the Mediterranean sanitaria need never be felt); the accommodation, hotel* and other, has greatly improved of late years; and of the general charm of the site no praise can be too high.

On the whole, Palermo holds a very attractive place among climates of the present class; and though I cannot adduce any instance in which *quasi-cure* followed a stay there, I have observed many cases in which, I am as convinced as one can be of any proposition not mathematically demonstrable, prolongation of life for some years was due to its controlling influence over the congestive and inflammatory phenomena of pyrexial phthisis.

1547. *Ajaccio*.—The latitude, aspect, surroundings, site, and vegetation of Ajaccio point to it as a moist, warm spot most likely to rise into future importance as a winter asylum.† Looking to the south over a miniature imitation of the Bay of Naples, visited by little, if any, habitually violent wind, protected from the north-west, and surrounded with a genially soft and humid atmosphere, the town is bright and cheerful in aspect, and, in process of time, will be sufficiently provided with the accommodation necessary for strangers.‡ As very generally throughout Corsica, malarial influence is felt in summer and autumn.

1548. *Corfu*.—Stormy, moderately moist, with rather a high rain-fall, enjoying a winter temperature of 54° Fah., exposed to all winds, and these often changing abruptly and violently from hot to cold, and *vice versa*, subject to frequent fogs, and not exempt from visitations of snow, Corfu, especially since its separation from the British crown, seems to have little claim to preference over other softly humid spots of easier access.

1548.* *Zante*.—Zante, warmer than Corfu, and less windy, is well supplied with food,—and, as evidence of its mildness, the fact may be mentioned, that at Christmas this island exports bouquets all over continental Greece. But, unless special circumstances render it a desirable spot, the claims of Zante may safely be ignored.

* The "France," though in hotel rank inferior to the "Trinacria," has a better exposure, and is well provided with fire-places.

† See the charming volume of Dr. H. Bennett, "Winter and Spring on the Shores of the Mediterranean," 3rd edit., 1870.

‡ M. F. ussagrives, however (vol. cit. p. 610), considers that the insipid monotony of life at Ajaccio more than does away with the good of its excellent climate.

VII.—EASTERN ATLANTIC SUB-GROUP.

1549. *Madeira*.—Enjoying a mean winter and spring temperature ranging from about 59° to 65° Fah.,—a temperature of extraordinary equability from day to day, from month to month, and from season to season, with little practical difference between the heat of day and night,* and permitting the invalid to remain out of doors the greater part of the day; free from dust, though the soil be dry; bathed in an atmosphere loaded with aqueous vapour, sometimes to the saturation-point; very windy; free from surface-fog or mist, but daily overhung with a canopy of cloud from about 9 a.m. till the early afternoon; subject to considerable winter rain-fall after the manner of tropical countries; well supplied with food and many of the luxuries of life; remarkably clean, and surrounded by scenery surpassingly lovely and wholly novel to the European eye, Funchal, where winter, in the northern sense, is unknown, was long considered earth's choicest refuge for the phthuseical.

But much of this promising character turns out to be practically delusive. The damp is so extreme (boots laid aside for a day become covered with mould; lucifer matches cease to be inflammable; iron rapidly oxidises, &c.), that changes of temperature thermometrically small—of 3 or 4 degrees—prove sensationally great; a temperature of 58° indoors, without being actually cold, is disagreeably chilly; the thermometric equality is but an annoyance to the sensitive invalid who perpetually suffers from the physiological effects of slight change,† while the high night-temperature in-doors makes sleep less restorative than it ought to be; alternations of dryness and moisture occur with great rapidity; the blowness of the town clashes with comfort; there are few amusements, either frivolous or intellectual, within reach,—the somewhat perilous diversion of the descent of the "Rocket Road" soon palls; level ground (except along one road about three miles

* Such is the statement invariably made by those who have wintered at Funchal. Dr. Grabham, however, in his careful and interesting work, "*Climate and Resources of Madeira*," p. 129, fixes the mean difference at 9° Fah., "the mornings and evenings being cool and the freshing."

† Paradoxically enough, however, the new arrivals seem to suffer less from this form of annoyance than persons whose sojourn has been a prolonged one. There is a parallel fact to that observed in the case of natives of very hot countries wintering in London. I have repeatedly ascertained from Parsee and Hindoo students at University College, as well as from Parsee merchants established in London, that they suffered less from cold in their first winter than in subsequent ones. English people, commonly, when obliged to pass successive winters in Malta, suffer more and more from the intense heat the greater the number of years they remain.

long) is not to be had for walking exercise; there is too much swell in the bay for agreeable boating;—invalids, however, can avail themselves of the passive monotony of the palanquin and hammock; occasionally (but rarely in winter) the dry scorching wind (leste) from the African desert withers everything during its three days' habitual stay; and, finally, the difficulty an invalid must encounter in getting away, should the island be found to disagree, cannot be forgotten.

Persons newly arrived suffer from depression of spirits, nervousness, breathlessness, and intestinal disturbance; on the other hand, local irritations improve, and the pectoral symptoms lessen in activity. But in the long run these effects, both good and evil, pass away. Dr. de Castro (now of Nice) informs me that of 13 *bonâ fide* phthisical sufferers who went out in the same ship with himself to Funchal, some years ago, 9 had died by the end of the season, 2 were dying, and 1 held on in a very precarious condition. Several of the number were by no means in an advanced stage. Some returns supplied by Dr. Lund, however, give a very different version of the capabilities of the climate.* One hundred cases turned out as follows:—

First stage.	Arrested.	Went on.
45	37	11
Second stage.		
24	5	19
Third.		
28	5	23
—	—	—
100	47	53

If stay at Madeira usually ensured arrest of the disease in 47 per 100 of cases, the climate would, indeed, take the foremost place in the list of sanatoria! But compare with these figures Dr. Renton's results: of 47 cases of confirmed phthisis, 44 died (32 within six months of their arrival); the fate of the remaining 3 was, too probably, death. It is true, Dr. Renton's tables further show, that of 35 cases of "incipient" phthisis, 26 left the island much improved;† but the proportion of these "incipient" cases, really tuberculous, is most fairly open to doubt, seeing that the diagnosis was made as early as the year 1827; in point of fact, Dr. Renton very honestly admits this (p. 307).

* Assoc. Med. Journal Sep. 1859, p. 772

† Ed. Med. and Surg. Journal, vol. xxvii. 1827

It cannot be contested that cases of true phthisis in the third, as well as the first, stage have practically recovered after sojourn in Madeira, while in others life has been materially prolonged. I do not think there is any period of the disease, therefore, at which (provided the patient's idiosyncrasy and the character of the symptoms appear to demand a *very sedative* climate) a trial of Madeira should be interdicted. The trial is especially hazardous, be it remembered, in the *early* stages, and may by possibility prove downright mischievous, if the case be already one of the low, quasi-adyynamic type. On the whole, Funchal seems best adapted for consumptive patients for whose comfort a humid, soft air has grown a necessity, and in whom relief of irritative symptoms is the only good to be hoped for. I cannot help believing that, as far as the diathetic vice of phthisis is concerned, the climate in the mass of cases is at least useless, possibly pernicious. Of its habitual utility in sufferers from bronchitis, especially of the dry kind, from emphysema, chronic pneumonia, and some forms of asthma, no doubt can be entertained. The climate of Madeira notably resembles that of Ceylon;* and there, with the soothing, equable, and very warm atmosphere, it has been found that, after softening has occurred, the disease is likely to advance with great celerity.†

1550. *The Azores*.—Somewhat less equable in temperature and still more humid than Madeira, the Azores have no claim of any kind to preference over the latter island.‡

VIII.—NORTH-AMERICAN SUB-GROUP.

1551. If circumstances have led the patient to winter in Cuba, he may proceed to Florida, South Carolina, or Georgia at the end of April, and remain in any one of these states (Florida the most promising) till the end of June.

Where marked heat is desirable, especially from its being agreeable to the feelings of the patient, Cuba will afford numerous available spots for winter residence. But I have only known a few

* Emerson Tennent's "Ceylon," vol. i. p. 79, 5th edit., 1860.

† None of the winter sanatoria have been the subjects of so much overwrought praise, on the one hand, or undue obloquy on the other, as Madeira. The former may be found in abundance in the volume of Clark; the latter in Captain Sayer's clever, but fretful, essay in the "Fortnightly Review." No one seems to have formed a lower estimate of its utility than the natives themselves. "There goes another Englishman to the orange-tree" (the burying ground), has become the joke among the boatmen on loading these unfortunates on the island." Dr. Benton gives this piece of feeling pleasantly done it, p. 366, as if applied to sufferers in the last stage only; but how these vulgar facts diagnose the stage does not appear.

‡ Buller, "A Winter in the Azores."

instances (and these in the case of natives of the island or the adjoining mainland), where the winter was actually passed there.

IX.—WESTERN ATLANTIC SUB-GROUP.

1552. *Bermudas*.—With a winter average of 65° Fah., Bermuda, exposed proverbially to all winds, and these of great violence, now damp and oppressive, now dry and cold, with a very dry soil, dependent on the rain-fall for water, affords an oceanic winter asylum to many American phthisical sufferers, and might perhaps, with advantage, be utilised by some of our own.

1553. *Bahamas*.—There are several spots in the Bahamas where the winter, of a mean temperature of about 70° Fah., may be passed with comfort, though cold winds and rapidly-varying temperatures are by no means unfelt.

X.—WEST INDIAN SUB-GROUP.

1554. The information, collected from various sources by Clark,* proves very satisfactorily that the climate of the West Indies is unsuitable in cases of tuberculised lung. Dr. Hunter, speaking of Jamaica, and admitting that the disease rarely originates in the island, believes phthisical immigrants are more rapidly destroyed than they would have been in a more temperate air. Yet stronger language is used by various of our Army medical officers stationed from time to time in the island. The forcible opinion of Rufz, as to the acuteness and rapid course of the disease in the island of Martinique, witnesses in the same direction [1527, m].

On the other hand, it is affirmed by a variety of physicians who had practised for some years in the islands, that in cases of young persons hereditarily predisposed to consumption, the influence of the climate is very favourable: I have had two young patients with very slight physical signs at the apices, who, being led by special circumstances to winter in Jamaica, at a slight elevation among the hills, returned to England in improved health.

XI. VIRGIN ISLANDS SUB-GROUP.

1555. *Santa Cruz*.—During a winter spent on this very small island, it is stated that the thermometer never rose above 84° and never fell below 70°; the winds were just sufficient to be grateful; showers frequent but of short duration. The houses being more or less open day and night, a mild fresh air from the ocean is con-

* "Sanative Influence of Climate," 3rd ed., p. 212.

stantly inhaled.* The great and unchanging heat had proved very distressing to a young Danish lady, who came under my notice after a winter passed in the island: but the high temperature in this instance did no real harm.

GROUP II. STIMULANT CLIMATES.

1556. Climates belonging to this group are dry, stimulant, bracing, tonic, exciting, and, as a rule, exhilarating. But in their evil aspect they are irritating, disposed to excite congestion of the pulmonary mucous membrane and parenchyma, to generate dry cough and diminish bronchial secretion where it has been copious, to promote the occurrence of hæmoptysis, to render "nervous" people yet more nervous, and prevent, rather than conduce to, sound and refreshing sleep.

1557. The cases for which these climates are fitted are, in all respects, the converse of those adapted to the Sedative Group.

1558. The entire group may be subdivided as follows:—

Sub-Groups

- | | |
|----------------------------------|---|
| I. British Isles | Worthing; Hastings; St. Leonard's; Grange; The Undercliff, Clifton. |
| II. Shores of the Mediterranean. | Hyères (Cote d'Azur), Cap d'Antibes, Cannes; La Cannelle; Nice; Cimiez, Villefranche, Monaco; Menton; Bordighera; San Remo; Pegli; Nervi; Spezia. |
| III. Mediterranean Islands . | Capri, Sicily (Catania); Sardinia (Cagliari); Malta; Majorca (Jollit). |
| IV. The Peninsula | Alicante, Barcelona; Gibraltar; Malaga; Lisbon; Cadix. |
| V. North Africa | Egypt, Nubia and the Desert; Algiers; Tangiers; Mogador; Canary Islands. |
| VI. South Africa | Cape Town; Natal; The Desert. |
| VII. Australia | Victoria. |
| VIII. Tasmania | Hobart Town. |
| IX. New Zealand | Auckland. |

I—ENGLISH SUB-GROUP.

1559. *Worthing*.—Situated almost absolutely on the sea-level, sheltered partially to the north and east by the South Down hills, occasionally foggy, with a mean winter temperature of about 42° Fahr., and a porous soil, Worthing, somewhat milder than the West Cliff of Brighton, but like it exposed to the full force of south-western gales, is fairly well adapted to patients of languid, leucophlegmatic temperament, constitutionally averse to heat.

1560. *Hastings*.—Hastings does not commend itself to Londoners by its warmth: the mean temperature stands slightly lower in the winter, and upwards of a degree lower in the spring

* Sweetser, "On Consumption," p. 252.

than in the metropolis.* When the additional influence of the wind on sensational warmth is considered, this inferiority becomes serious. And yet Hastings is not without its attractions: moderately cheerful, often brightly sunny, and sometimes even brilliantly clear, protected within a certain area from the north and the north-east winds by the lofty Castle Rock, spots may be found passably soft and genial,—bracing in their effects on some people, relaxing, on the contrary, on others,—where the consumptive invalid may wear through the winter, if not enjoyably, at least without downright climatic suffering. The main drawback of Hastings lies in the fierceness of the south-western gales: they are not, however, of long duration.

1561. *St. Leonard's*.—Continuous with Hastings, fronting the sea, St. Leonard's is cooler than its neighbour, and much less well-protected from the north.

1562. *Grange*.—Picturesquely situated on the shores of Morecambe Bay, fairly well-sheltered on the north and east, this spot, but little known, appears to offer a striking example of the singular modifications which local influences may exercise on the regional characters of climate. Myrtles thrive well, unprotected, till after Christmas: one specimen has been known to stand out in open air for more than twenty years. The quality of the air is soft and soothing; and the thermometer often marks ten degrees higher here than at Kendal and the surrounding spots. The rain-fall is greater than at Torquay, while the number of rainy days is about the same in the two places. The hotel accommodation is spoken highly of. On the whole, I entertain no doubt Grange offers a favourable winter and spring asylum for consumptive invalids, especially from the northern districts.

1563. *The Undercliff*.—The climate of this remarkable landslip, protected from northerly blasts by hills some five hundred feet high, and itself rising to about one hundred and fifty feet above the sea-level, is genial, yet not notably sedative. The number of rainy days in winter and spring is somewhat greater than at Torquay, but the quantity of rain in inches considerably less: the soil allows of ready percolation. The mean winter temperature ranges about two degrees lower than, while that of spring about equals, that of Torquay. Ventnor and Bonchurch are both dull places; but their charming scenery reconciles the invalid in great measure to the absence of out-of-door enlivening occupations.†

* Clark, *op. cit.* Tables, p. 374.

† G. H. Martin, M. D., *The Undercliff, 1849; The Isle of Wight*, by E. P. Watkins, M. D.

1564. *Clifton*.—With a temperature in winter about 3° lower than, and in spring about the same as, Torquay, Clifton, except in its low-lying parts, is considerably drier than the Devonian town. Beautiful in site, bright and exhilarating in air, provided with numerous sheltered spots for exercise, protected, except in its upper parts, from northerly winds, offering different degrees of warmth at different elevations and exposures, this is an excellent locality, especially in the spring, for cases of apyrexial phthisis, where the patient is instinctively averse to high temperature.

SUB-GROUP II.—SHORES OF THE MEDITERRANEAN.

1565. On the long stretch of shore, reaching from Hyères to Spezia, stand a number of spots of more or less value as winter sanatoria for the phthisical. These spots, with many minor differences, possess some leading qualities in common. In all the air is light, dry, exhilarating, bracing, warm, fairly equable; the sun vividly bright, the atmosphere luminous. All are more or less exposed to cold winds; in all there is a change of wind twice in the twenty-four hours; in all the mornings and evenings are cold; in all it may be too hot in the sun, and too cool in the shade, at one and the same moment,—so that sensationally the result is a “summer’s day iced.” In all the difference of temperature between rooms looking north and south is great, varying from 8 to 12 degrees, and in many of the group the clefts in the protecting mountains give easy ingress to northern blasts.

Let us now pass these stations in review from west to east.

1566. *Hyères*.—Seated on the southern slope of irregular hills* at a distance of about two and a-half miles from the sea, from which it is separated by a richly cultivated plain, studded with palms and orange trees,† and exhaling a flower-perfumed air; enjoying a mean winter temperature of about 13°·5 C. ‡ with a small diurnal range; sensationally and really cold in the mornings and evenings, and subject, especially through the influence of the Mistral, to abrupt changes of temperature; with an air habitually pleasant to the feel, sometimes keen, rarely harsh, drier, according to Carrière,§ than that of any spot on the Mediterranean; very

* The “*Montagne des Maures*.” Falsen, *Géol. et Minéral. du Canton d’Hyères*, 1893, with a geological map.

† Denis however admits the orange-trees are neither so hardy nor so fine here as at Nice and Villefranche. “*Promenade Pittoresque à Hyères*,” Of lemon-trees nothing is said.

‡ Honnoraty, “*Le titre sur Hyères*,” 1846.

§ *Op. cit.*, p. 570.

rarely foggy and seldom cloudy; nevertheless damp and rainy sometimes, yet less so in winter than Nice, and not *coldly* rainy; rarely frosty, though few winters pass without the thermometer falling below the freezing point;—Hyères recommends itself to notice *in primis* on the score of its easy accessibility.

November and December, as at Nice, are the most genial months; a series of bright exhilarating days (unblighted by the real banes of Hyères, as of Provence generally, the N.W. and N.N.E. winds, the Mistral and the Bise) is then not uncommon.* The dull monotony of life is complained of; but for real invalids out-of-door gaieties are undesirable.

Exceptional events are: moderate, prolonged frosts sufficient to destroy the orange trees, or sudden great fall of the thermometer even as low as 20° Fah.; violent hurricanes of some days' duration with clouds of dust; and continued rain and dampness.

1567. *Costebelle*, a suburb due south of the town, hidden among the hills, milder and softer, though damper than Hyères itself, is an admirable spot for those who are content to live to themselves.

1568. *Carqueiranne*, lying to the S.W. of Hyères, close to the sea, is much better protected from the Mistral, and may be resorted to for marine air. Its accommodations are, however, at present of the most primitive kind.

The contrast in the climates of Pau and Hyères is not greater than that in the dispositions of their inhabitants,—the listless indolence of the Béarnais as striking as the impetuosity of the Provençal—"violent as his own Mistral."

Four characters may be said practically to stamp the climate of Hyères: it is dry, bright, moderately warm, and frequently chilled by cold winds. On the whole it has appeared to me a safe station,—and in a few instances arrest of the disease, maintained for years, has followed a sojourn of one or two winters there.

The reputation of Hyères stands less high as a resort for the phthisical than formerly: can this be due to the draining of marshes? It is certain that in the Department of Var phthisis seems to have taken the place of intermittent fevers, since the marshes of Bras, St. Laurent and Fréjus have been dried up.† Still, Rochard, so severe a critic of phthisical sanatoria, considers Hyères "the sole spot in the south of France fit for con-

* According to Denis these winds blow severally 27 and 20 days annually. The N.N.E., the "Bise des Alpes," appears to be the most common wind in winter.

† Boudin, "Géologie Médicale," p. 42.

sumptive people."* This was written, however, before the recent French annexations of Italian territory had been effected.

1569. *Cannes*.—Built almost on the sea-level, close to the shore, facing a group of small islands (Les Lérins), which act as protectors from southerly gales to the opposite portion of the bay; exciting (possibly from the electrical condition of the air), bright, cheerful, and exhilarating; apparently screened to the north and north-west by the thickly wooded and shrubbed Estrelles chain, which however really lies too far away, and is too low and too broadly fissured to efficiently ward off northern blasts, especially the Mistral; rarely visited by cold, damp, or fogs; less dry, certainly, than Hyères and Nice; of a mean temperature, *during the usual hours for taking exercise*, in the coldest months, ranging from 55° to 62° in the shade, and reaching 100° to 115° in the sun; † chilled by but few rainy days (chiefly in October and November); its rainfall abundant in quantity and short in duration; rarely frosty even at night, yet in exceptional years so intensely and so protractedly so, that even the olive trees perish; surrounded by most interesting scenery, displaying landscapes green even in mid-winter from the abundance of pine, olive and orange trees; the very garden of Flora, its atmosphere ever redolent of fragrant flowers;—Cannes possesses abundant attractions for the invalid, whose disease has not yet deadened within him all faculty of enjoyment.

The following extract from a "Register kept by an English Clergyman," 1868-9, furnishes some significant facts:—

	Nov.	Dec.	Jan
Sunny days per month	22	26	28
Average number of sunny hours daily	4	6	5½
Rain on days	8	5	2
Humidity at noon, saturation = 100	78	75	72

But though the air is, on the whole, less irritating than that of Nice proper, and even of Hyères, nowhere is the treacherous quality of the Mediterranean climates more vividly felt than along the shore of Cannes. On the other hand, if the precautions, dictated by common sense, be fully and unremittingly observed, Cannes may be trusted as a not actually unsafe place even in advanced consumption of asthenic type.‡

* *Mém. de l'Acad. de Méd.*, t. xx, p. 145.

† "Sketch of Cannes," by M. de Valcourt, p. 42. The Meteorological Tables published by this observer at Cannes, are among the most detailed and elaborate I have ever seen.

‡ Cannes, as is well known, was a mere fishing village, till Lord Brougham, by fixing his winter residence there, raised it at once into celebrity and prosperity. "Les Anglais ont été la Providence de Cannes," as a Frenchman once said to me.

1570. *Le Cannet*.—The village of Le Cannet, sunk in a gorge, about two miles inland, well protected from the N. and W., enjoys all the picturesque advantages of Cannes, with an air rendered much less exciting by the distance, though so slight, from the sea. Irritable cough, engendered or kept up by the keener air of Cannes, will here often disappear at once. When provided with proper accommodation (progress is going forward in this direction), Le Cannet, I am disposed to believe, will prove a most valuable station, holding a medium place between the stimulant and the sedative groups.

1571. *Nice: (a) Nice Proper*.—Occupying a portion of a wide open basin of great beauty, at the mouth of the fitful torrent, the Pagliano, directly facing the very bluest and most transparent sea, Nice, on first examination, looks well protected by the Maritime Alps from northern atmospheric influences. But, as matter of experience, north winds make their way both over the tops of these hills, and through wide clefts that fail to bar their passage. Probably no spot along the Mediterranean shore suffers more severely from the Mistral than Nice; the north wind, however, seems to pass over the town and impinge on the sea at some distance out. The east wind in spring is very keen. The southerly winds are depressing; the S.W. (*Liberccio*) occasionally very violent. As a rule, a warm and moistish current from the sea prevails by day, replaced by a cold, dry night-current from the land: the change in the evening especially is sudden and accompanied with much real and more sensational cold; the Mistral is an exception to this diurnal arrangement, blowing most fiercely by day. Besides all this, the wind may, and often does, change its direction four or five times daily. The dust in exposed parts, especially the Promenade facing the sea, is something terrible.

The winter temperature stands at a mean of $46^{\circ}33$, that of spring at 56° . The thermometer seldom falls below 32° . The lemon tree, however, either proves a failure, or almost a failure, in the open fields.*

The quality of the air is pure, light, transparent and exhilarating; but it is dry, keen, and markedly irritating. A susceptible mucous surface knows little peace under its influence.

Rain falls largely in October and November; but the number

crossing the Estrelles in point of fact, Cannes is almost as much an English creation as Hatanga or Torquay.

* *Carrière*, op. cit.

of rainy days is small. According to the hygrometer of Saussure the mean humidity for fifty years equalled 58.2, the maximum 94, the minimum 17.* The number of sunny days averages 109 in winter and spring; the dull and cloudy 37. The sun's rays are very powerful; the glare distressing to delicate eyes. The barometric variations appear to be singularly slight.

Oddly enough, English invalids in days past adopted the most exposed part of the town, that directly facing the sea; and probably in ironical compliment to their want of judgment the Marine Esplanade has been named "*Promenade des Anglais*." The Corso, the Port, spots under the Castle Rock, would be infinitely preferable to the Croix de Marbre district, which should be especially avoided. But, although (perhaps because) built on the site of a quondam swamp, the Carabacel suburb is the best locality for such phthisical sufferers, as, *missing their way*, may determine on staying in Nice Proper.

It is conceded by the local practitioners that Nice should be left before the so-called "*Luna Rossa*," the red moon of March. But the fierceness of the winds makes it advisable, I am satisfied, that persons of really delicate chest should not remain longer than mid-January.

Volumes have been written on the merits and demerits of Nice. Rather than attempt the task of condensing their conclusions, let me state in a few words the results of my own observation of the actual effects of the climate in genuine phthisis. 1. In no stage, in no degree, in no form of tuberculisation of the lungs, and no matter what be the temperament of the individual, is Nice Proper a *safe* winter resort. 2. The climate is most dangerous in cases with hæmoptoic and laryngitic tendencies. 3. It is a mistake to suppose that, if the expectoration be abundant and the skin disposed to act very freely, *ergo*, Nice will of necessity benefit the patient. It *may* disagree with him more than with a fellow-sufferer whose bronchial and cutaneous secretions are in the precisely opposite condition. 4. It has not occurred to me to observe a single case of positive arrest of phthisis established by sojourn in the English, that is the "*fashionable*," quarter of Nice.

1572. (*b*) *Cimiez*.—On a hill to the north-east, amid groves of olives, stands the suburb Cimiez. Though only two and three-quarter miles from Nice Proper, the climate here is singularly

* Macario, "*Influence Médicatrice du climat à Nice*." The classical work of Rich. Linn may also be consulted, as likewise that of Roulaudi, "*Nice et ses Environs*."

different from that of the Croix de Marbre; the specific irritating keenness of the Nice air is no longer perceived, and an approach to the soft genial impression of the atmosphere of Pisa or Palermo experienced; I have felt this difference even on a broiling September day. Open air exercise proves permissible with perfect safety amid the Cimian olives, when it would assuredly be more than hazardous to venture by the sea-shore. Oftentimes a perfectly still and balmy air may here be enjoyed, while hurricanes of dust well-nigh blind the venturesome *faneur* of the Promenade des Anglais.

The most eligible sites are the southern and the western slopes of the hill, and that of Brancolar. On the eastern slope strong wind blows in the line of the Pagliano, and quite at the summit the cold influences of the snow-clad mountains beyond are distinctly felt.

I have no special meteorological data concerning Cimiez. Yet of its safety, as a winter resort for the phthisical, experience has taught me to entertain no doubt, provided the patient be one of those who can exercise self-control, and never venture into the town, unless when unvisited by Mistral or other form of noxious wind. I have had a certain number of cases under observation, in which as near an approach to absolute arrest followed a winter at Cimiez, as has been effected to my personal cognizance at any spot on the Mediterranean.

1573. *Villefranche*.—Separated from Nice by narrow ridges of hills, which serve for its western protection, Villefranche differs climatically to a remarkable amount from its immediate neighbour. Notably warmer and softer in the quality of its air than Nice, (a superiority due to its position at the inner and western point of a narrow bay, protected from N., N.W., S. and S.E. winds by the heights around,) its sustained night-and-day temperature must be higher even than that of Menton, for the lemon tree not only thrives admirably in the open fields, but the fruit ripens earlier than at that place.

Villefranche is unsuited at present for the reception of invalids, its accommodation being of a very primitive order. Were this otherwise, the little town might possibly very soon eclipse in popularity its eastern and western rivals. M. Carrière* believes it probable, that experience would prove it to be the best station of the entire sea-board from Genoa to Toulon.

1574. *Monaco*.—Monaco is tolerably well-protected from the

* Op. cit., p. 512.

due north, but fully exposed to winds coming from other points of the compass. The entire group play upon this "orangery on a rock" with the most abrupt variability, and render it an unfit place of sojourn for the phthisical.

1575. *Menton*.—The "legend of the founder of the invalid season at Menton," as M. de Longperier* quaintly styles the story of the arrival of the pioneer English sufferer, dates no further back than 1855. The spot is consequently one of the most recent additions to the series of winter sanatoria; yet it has already acquired an amount of popularity greater than that of almost all its elders in the field.

The perfection attained by the lemon tree, flourishing, as it does, luxuriantly in the open plain, proves the climate of Menton to be warmer than that of Nice, Cannes, and Hyères. Nevertheless the thermometer frequently falls below 32° during the winter months; and the air must on the whole be called cool, and often would be downright cold, but for the vivid rays of a burning sun, and the protection afforded from northerly winds by the sun-heated rocks, by terraces of hills and by mountain-ranges, rising successively above the town. In the eastern bay, this protection is felt to by far the greatest amount, and the resulting heavy warmth, combined with the comparatively impeded movement of the air, may have played an important part in giving Carnière the impression that Menton really belongs to the sedative class of climates.† But though many of our own invalids unconsciously echo the French writer by denouncing the Englishman's climatic bugbear, the "relaxing quality" of the air of Menton, there can be no doubt it possesses in the main the bracing and stimulant characters of the entire western Riviera.

The leading qualities of the winter climate are shown in the following table, founded on the twenty years' observations of M. de Brea and Dr. Henry Bennet. ‡

	Mean temperature	Rainy days.	Cloudless days.	Days of mixed sun and cloud.	Sunless days.
November . . .	54.6	9.5	15.5	4	1.2
December . . .	49.5	11	19.5	4	2
January . . .	48	8	17.3	2.5	2.5
February . . .	49.1	5.5	16.3	3	3.3
March . . .	52	6	18	4	3

* "L'Hiver à Menton," 4to, 1862, with very excellent photographs. See also Dr. Bennet's book already quoted; and Suardet, "On the Climate of Menton."

† *Op. cit.* p. 509. He grounds his opinion also on the physiological attributes of the native population—the rotund fulness of person of the women, and their indolent *allures*.

‡ *Op. cit.*, p. 584.

The wind blows commonly from a northerly point during these months, but the sun is then, as a rule, bright; the warmer southerly breezes bring cloud and rain. Rain occurs occasionally with almost tropical violence, but it rapidly disappears by absorption and evaporation. Dews, more abundant in the western than the eastern bay, are, on the whole, not heavy; hail occurs on an average twice a year; snow falls half a day annually;* fog is extremely rare; and the air is said to be seldom cold and wet at one and the same time. In houses close to the shore the spray reaches the interior, just as at Brighton or Hastings, when a strong breeze blows from the seaward.

Nervous invalids complain of the irritating noise of the perpetual to and fro movement of the sea: some of the number lose their night's rest frequently from this cause.† In fire-warmed rooms, mosquitoes may harass the occupants all the winter round; still, a southern aspect, with plenty of sunshine, is indispensable.

Possessed of a meteorology so favourable, beautiful in itself, and surrounded by a country of great scenic interest, Menton fairly rivals, as a pleasant and innoxious winter sojourn, any well-protected, vividly sunny spot of moderate temperature. But, though phthisis is affirmed to be of most rare occurrence among the natives,‡ the following general statement (for which physicians are indebted to the conscientiousness of Dr. Bottini), satisfactorily shows that the curative influence of the climate on imported consumption is not greater, though doubtless not less, than that of the Riviera generally.

The return is furnished by the cases of 125 patients from various countries; as the cases were contributed by five successive winters, "exceptional" climatic conditions are very unlikely to have influenced their course.

Stage of disease	No. of cases	Result
First	55	Arrested 31
		Went on 25
Second	36	Regained strength and flesh . . . 8
		Went on to death 28
Third	33	All died soon after passing relief . 33

Now these results are very much the same as those obtained at Brompton: "all patients, whose tubercles were yet unsoftened

* Bottini, "Menton et son Climat," p. 92 1868.

† This is an objection to Menton which is fast being removed; two hotels and several villas have already (1871) been built at some distance from the beach.

‡ Bottini *op. cit.*, p. 116 states that 1 only of every 55 deaths among the real *Mentonians* is due to phthisis.

on admission, left the hospital either improved, or having had a *status in quo* condition kept up. Improvement is more probable than the reverse, even where excavation exists on admission" [1315, 4].

1576. *Bordighera*.—About eleven miles further to the eastward lies Bordighera, celebrated for its palm groves. Struck by the luxuriant abundance of the tree, he has been wont to regard as the "type of the tropics," the wanderer from the north too hastily, and yet excusably, assumes, *here* must be the true climatic elysium of the Riviera. He soon learns, however, that the tree produces no edible fruit, and that it is cultivated specially at Bordighera, because the village enjoys the monopoly of supplying certain Papal ceremonials, in which palm-branches play the prominent part.*

Bordighera, as far as I can ascertain, is decidedly colder and less well-protected than either Menton or San Remo: seated on a promontory, it is freely exposed to east and west winds, and a wide cleft in the hills to the north, gives full access to the chilling blast from that quarter. Besides, it is notably duller than one or the other of its neighbours, though not deficient in comfortable accommodation. I have, however, had very few patients who have stayed there long, and would not venture to give any positive opinion as to the merits or demerits of the place.

1577. *San Remo*.—About seven miles further to the eastward stands the ancient town of San Remo. Though long since divined as a likely winter sanitarium, the spot has scarcely been known, certainly not utilized, for more than ten years, and may even now be said not to have passed its medical infancy.

Lying in a deep bay, looking due south, the town, rising in a pyramidal form from the shore,† is protected on the north by three successive groups of hills, ranging in height from 500 to 8000 feet, none of them cleft by torrent-beds, and all free from broad gorges likely to give passage to the winds; hence the tramontane passes over the town to seaward, while two promontories shelter the bay to the east and west. Yet further protection is afforded by groves of chestnut trees, and at the highest level by pine forests.

* Lamartine, speaking of Hyères, says, "Là les Palmiers et les Aloes d'Ichnée se trompent de ciel et de terre." And so they do, in passing phrase their presence in these temperate spots looks an *error loci*. And any of my readers who would care to know, what a charming dream poetic fancy may weave out of the climatic *mistake* of these Western Palms, should muse over the chapter "Under the Palms" of the "Nile Notes" of "A Howerly."

† "San Remo, by an Invalid." Liverpool, 1863. Also panoramic photograph.

Although there are certainly "cold, cloudy, gloomy, and wet days"* to be met at San Remo, the diurnal range of temperature seems to be smaller here than at other spots on the Riviera, and the mean temperature is higher even than at Menton. Mist and sea-fog seem to be almost unknown; † snow is very seldom seen, except on the higher hills, and ice only in very shady spots. The lemon-tree flourishes with peculiar vigour; the flora of the district is marvellously beautiful. The air is dry,—rainy days few and far between; the dust not seriously troublesome. The wideness of the space, encircled by the hills, allows of free (sometimes too free) movement of air in and about the town. The quality of the atmosphere seems to be tonic without being excitant, exhilarating and yet soothing. In a word, the spot seems to "combine in a modified degree the bracing qualities of Nice with the warmth but without the closeness of Menton."‡ The noise of the surge gives no annoyance here as at Menton,—the houses being built at some height above the sea-level.

The neighbourhood of San Remo abounds in picturesque villages and scenic objects of interest. For one of the former, Spedaletti, an important medical future may safely be predicted.

"Italians in heart, as well as nation, the San Remese are imbued with kindly feelings for English people."§ If this be the very truth, the fact might be thankfully accepted as counterbalancing many, many small evils; neither invalid nor strong man can love to meet, as he takes his daily stroll, the but partially suppressed scowl of dislike, or the contemptuous sneer of fancied superiority, that so often greet him in spots hard by.

I am inclined to place San Remo somewhat higher in the scale, as a safe resort for the phthisical (especially where there is hæmoptoic tendency and pyrexial or nervous erethism), than any spot along the coast at present known and resorted to, with the single exception of the Cimian hill [1572].

1578. *Pegli*.—Lying a few miles to the west of Genoa, and provided with an excellent hotel, this little place, not ill-protected from cold winds, has attractions for some in its perfect quietude and the Pallavicini gardens.

1579. *Nervi*.—Passing by Genoa, we reach the Eastern Riviera, where Nervi claims attention as the resort of native phthisical

* "The Climate of San Remo," by Prosser James, M.D., 1865. Exceptional periods will of course occur, as in January, 1871.

† "Climate of San Remo," by H. Daubeny, M.D., 1865.

‡ "San Remo: by an Invalid," p. 6.

§ Prosser James, loc. cit., p. 23.

patients from North Italy. The town is tolerably well shielded from the north by the mountains. My experience is, however, very limited concerning this place; but some few patients, who have wintered at the Anglo-Italian Pension, have passed through the bad season without discomfort.* As an instance of the diversity of opinion of invalids concerning these places of resort, I may mention that, while writing this page, I have conversed with an observant and most intelligent patient, who has passed winters, or portions of winters, at every one of the ordinary sanatoria on the Riviera, and has come to the conclusion that Nervi is "incomparably superior to them all!"

1580. *Spezia*.—The climate of Spezia, seated at the head of one of the finest bays in the world, five miles by four in dimensions, is represented as very agreeable; the town is shielded by mountain ranges on all noxious aspects, but they seem scarcely high enough to protect it efficiently, especially to the north-east. Rain is said to fall copiously. There is a good deal of malarial disease in the autumn, from adjoining marshes; but whether this fact should keep away the phthisical invalid in the winter may be more than doubted. However, unless there were special circumstances in the case, it seems hardly desirable to risk a trial of Spezia.

SUB-GROUP III.—MEDITERRANEAN ISLANDS.

1581. *Capri*.—At the eastern extremity of the Bay of Naples, about twenty miles from that city, seven from Sorrento, and about two from the nearest point of the mainland, lies the picturesque mass of rock, the small island of Capri. Abounding, to a marvellous extent in proportion to its size, in beautiful scenery, Capri enjoys a climate of notable salubrity. The thermometer does not often fall below 45° in spots having a southern aspect, and the island would deserve to be more sought by chest-invalids than it is, had not the mainly populated parts a northerly aspect, without protection from that quarter. The Villa Quisisana, seated on the southern side of the island, and sheltered by a chain of hills from north and north-east winds, is not open to this objection,—and here several invalids (some of them tuberculous in an early stage,) have within my knowledge passed the winter without accident of any kind. The distressing Sirocco of Palermo and Malta is unknown at Capri.

* The Pension is, or was, under the management of Dr. Millingen of Genoa.

1582. *Sicily*.—*Catania*.—Very sunny, drier and less sedative, and less seriously visited by the Sirocco, than Palermo, Catania, built at the foot of Mount Etna, and remarkable for its broad clean streets, enjoys a mean winter temperature higher than that of any of the frequented spots on the Western Riviera. Catania has a south-eastern aspect, and would probably be one of the very best winter sanitarium, were it not for its unfortunate proximity to Mount Etna. The upper belts of the mountain are, in truth, covered with snow during the winter, and when the wind blows from a northerly point, the blast is chilly indeed. I have no information as to the relative frequency and duration of the different winds at Catania; if those from a northern point were rare and short-lived, they might be escaped, without ill results, by remaining within doors during their stay. I have had but two patients who have passed the *entire* winter at Catania; the climate agreed well, the cases being rather of threatened, than of developed, phthisis.

1583. *Sardinia*.—*Cagliari*.—My medical knowledge of Cagliari is derived from the case of a single patient, to whom peculiar circumstances made the place a desirable spot of winter sojourn. His disease, which was slight, made no advance during the winter. The temperature is said to have been exquisite,—the accommodation and food fairly good.

The bay of Cagliari, several miles deep, is well protected from all winds except the south. The foreign portion of the town is conveniently and healthily built.

1584. *Malta*.—To the invalid the island of Malta is essentially represented by Valetta. This beautiful town, singularly clean and well built, and so seated on the slope of a rocky promontory, that good drainage is easily accomplished, is not open to the ordinary sanitary objections, so constantly urged against southern towns as residences for invalids.

The mean temperature of Valetta has been set down as 72° for October, 65° for November, 58°·5 for December, and 54°·5 for January. The diurnal range is small,—and from day to day but slight variation occurs. The atmosphere, brilliantly clear by day and by night, is seldom foggy,—nor are dews frequent or abundant. Hail is occasionally seen: snow, never. Thunderstorms with copious rain-fall are not very infrequent in the autumn; the number of rainy days per month from October to January averages 12.

Valetta is excessively windy; a day, remaining calm from first

to last, is of rarest occurrence. By far the most disagreeable wind is the north-east, or *gregale*,—if at all strong, it is sensationally very cold. Malta suffers more from the humid, depressing *sirocco* than any of the winter resorts, except Palermo; the languor caused by this wind is, however, very bearable, unless by persons of markedly lymphatic temperament, and does no real harm. Winds from south to south-west are hot and dry.

The defects of Malta are: its windiness, and the frequency of sudden fall of temperature, through change of wind, and at sunset; the intensity of the glare; the steepness of the streets;* the instantaneous change from hot to cold air at the corners of streets; the possibility of sun-stroke (easily to be avoided by reasonable care); the total absence of green foliage; the want of pleasant rides or drives, these being limited to dusty roads through a country but little diversified by hill and dale, and not at all by rivers or by lakes; and, lastly, the plague of mosquitoes and of sand-flies.

But on the other hand, the air of Valetta is mild, dry, softly bracing, exhilarating, and singularly bright and clear; the ground dries rapidly after rain; the town is clean, bustling, and cheerful; there is constant intercourse with home, and an Englishman may almost feel on his native soil; social intercourse is easy; there is an excellent opera (which, if unfit for the invalid himself, may be a matter of real importance to his companions); the rooms are on a handsome scale; the water is good; the markets are well supplied; and passive exercise of a most healthy character is to be had in the boats which ply for hire in the harbours.

The suburb Sliema, across the Quarantine harbour, is more open, healthier, and greatly quieter than Valetta. Casal Lia, about three miles from the capital, has been pointed out as peculiarly suitable for chest-invalids.

The best time for sojourn at Malta extends from the beginning of October to the end of January.

The native Maltese very rarely fall victims to phthisis. Nor can there, I think, be any serious doubt that the influence of the climate on apyrexial consumption, imported from Great Britain, will prove favourable, provided the necessary common-sense care be exercised, when the temperature suddenly falls from abrupt change of wind. I can very certainly aver, I have not known a

* said Lord Byron.

"Adieu, ye cursed streets of stairs,
How surely he, who mounts ye, swears!"

single instance, in which any evil changes in the disease could be fairly traced to the climate;—and I have had a small number of patients, advanced to the third stage, in whom a reprieve of *some years* might reasonably be credited to its influence. In one of these cases, so grave in all its aspects, that the attempt to reach the island seemed seriously hazardous, life was made abundantly enjoyable for three successive winters,—and might to all seeming have gone on for many more, had not a violent attack of pleuro-pneumonia of the better lung, brought on by chill in a *midnight* boating excursion, put a sudden end to life.

1585. *Majorca*.—Little is known of the climate of the Balearic Islands. But even Rochard admits he was struck by the favourable situation and salubrity of Palma in Majorca.* The town is seated in the depth of a bay open to the south, and protected from north winds by high mountains. The health of the inhabitants appears to be good.

A spot named Joller, in the interior of the island, is spoken of in strongly laudatory terms.

SUB-GROUP IV.—THE PENINSULA.

1586. *Alicante*.—Though seated on the same eastern shore of Spain as, and at no great distance from Valencia, and with the same general aspect, Alicante is as remarkable for dryness as its neighbour for humidity. The district, in which Alicante lies, ranks, in truth, as one of the very driest in Europe,—rain falling only twenty-four times annually: † the night dews are, however, abundant.

Though fairly protected from the north and west by mountain ranges, cold dry land-winds from those quarters do make their way into the town, alternating with soft, moist breezes from the seaward. There is little violent wind, snow and ice are hardly ever seen; but there is abundance of dust. The nights are said by one observer to be cold;‡ while, by another, their warmth is put forward as one of the principal recommendations of the spot.§

1587. *Barcelona*.—Sloping to the south and south-west to the sea, screened from northerly winds by ranges of low hills, Barcelona, a noble town, possessed of admirable urban and sea-shore promenades, and enjoying a mean winter temperature of 50-18, deserves more consideration as a phthysical asylum than it has

* Loc. cit., p. 144.

† Canave, op. cit., p. 153.

‡ Idem, p. 152.

§ FRANCES, op. cit., p. 204.

received. Several winters may pass without ice being visible; the diurnal range is singularly low, standing at only 5·4 for the month of December and January. From the averages of Dr. Yanes,* furnished by twenty years' observations, it follows, that in the six months, from October to March inclusive, there will occur 33 rainy days, 42 with overcast sky, 67 with some cloud, and 73 wholly cloudless. Barcelona, more humid than Alicante, is greatly less so than Valencia. About three miles distant are malarious rice-fields; they do not appear to generate ague in the town.

Gracia, on the slope of the hills to the north, seems peculiarly well adapted for the pulmonary invalid by its bright, warm geniality and quasi-tropical vegetation.

The splendid opera-house at Barcelona is a fair ground of attraction for the companions of the invalid.

1588. *Gibraltar*.—Built on the eastern aspect of the Rock, enjoying views of mountain and sea of almost unrivalled magnificence, provided with a noble promenade and a fair supply of ground for exercise, by no means despicable in its hotel accommodation, Gibraltar has especial claims in a national and social aspect, to become the sojourn of the English invalid.

And yet, though the temperature is very mild (that of winter averaging 58°, and of spring 66·25), though snow is very seldom seen, and ice never forms more than a mere pellicle, Gibraltar neither has been, nor deserves to rank as, a popular place of winter resort. The spot is in truth subject to very sudden changes of wind and temperature; hail-storms are common; the town suffers severely from the Levante, or south-east wind, which, bringing in its train mist, fog, and raw damp, may last for weeks, and is so distressing to animal life, that even the monkeys of the Rock leave their usual *habitat* on the eastern aspect to take shelter on the western side during its prevalence.† The sanitary state of the district is far from having even approached perfection.

Despite these drawbacks, I have occasionally allowed consumptive invalids in all stages to repair to Gibraltar, not because I believed it to be the most fitting sojourn, medically speaking, but because family reasons lent the place special attractions. And, I am bound to confess, the result of the winter has occasionally proved more satisfactory than in the instances of persons sent to the very spot of earth, which mature consideration had pronounced to be climatically the most appropriate. Still, these cases have not

* Quoted by Francis, *op. cit.*, p. 248.

† Francis, "Change of Climate," p. 167.

made me a convert to the desirability of adopting Gibraltar as an ordinary winter asylum; but there can be no objection to a brief stay there in the early part of the season *en route* to Malaga, Malta, or Egypt.

1589. *Malaga*.—Medically speaking, Malaga may almost be said to represent Spain,—and it indubitably holds the first place as a winter sanitarium in that portion of the peninsula.

Built in the form of an amphitheatre on sandy soil, recovered from the sea, the new part of Malaga looks south-east across a wide expanse of the Mediterranean,—and the whole city is protected by a semicircle of mountains, especially to the north and west, rising to the height of 3000 feet. On the north-west aspect, however, is a broad and deep river-cleft, which permits the free ingress of wind from that quarter to the town.

The mean winter temperature oscillates between 54 and 56, that of spring is estimated at 62·55. The mean daily range amounting to 4·1 only,*—in this respect excelling even Funchal, where the daily range stands at 9·5.

The air of Malaga, singularly dry, is yet free from the specific irritating qualities of that of Nice: the nakedness of the surrounding soil probably combines with other conditions in lessening the amount of floating moisture.† The morning dews, are, however, excessively abundant. Rain is so rare, that it fell, according to the observations of Martinez,‡ only 262 times in nine years, chiefly in January and February,—giving an annual average of 39 rainy days. In the same nine years, there occurred only 16 cloudy days. Occasionally, considerable fog forms at sunset.

The only really noxious wind felt at Malaga, the north-west, or so-called Teral, enters by the opening in the mountain-range, already referred to. Possessing the blighting attributes of the Mistral, keenly dry, accompanied with dust and fine sand, and sensationally very cold, though lowering the thermometer very slightly, it is fortunately of rare occurrence, and scarcely ever lasts more than two days. The east wind commonly blows from morning to the height of day; pleasant in summer, it is cold in winter: at about three o'clock it gives place to a land breeze,—a change ushering in a notable fall of the thermometer.

The perpetual sunshine and intense luminousness and light

* Francis, "Change of Climate," p. 175; 1853. The mean temperature of spring is given as 68°, by J. M. Madden on Climate, p. 144.

† Cazenave, "Du Climat de l'Espagne," p. 176; 1863.

‡ Quoted by Cazenave, *op. cit.*, p. 178.

transparence of the atmosphere are more striking than even in any part of Italy. The vegetation, really quasi-tropical, is decidedly in advance of any spot on the Riviera. The walks and drives in the neighbourhood are diversified and beautiful; and in the Alameda is an agreeable public promenade. There is little other amusement. Complaints of the hotel-food and accommodation have several times been made to me by returned patients,—but there is reason to believe, both are improving, though the substantial difficulty of “tough, dry, and lean” meat * seems one not easily to be surmounted. The grave defect of Malaga is the revoltingly primitive condition of the sanitary arrangements;—whether the frequent visitations of pestilence in the town are logically traceable (as has been assumed) to this cause, may be made subject of question. Surely Malaga is not filthier than Venice, where zymotic diseases are on the whole rare and free from excessive virulence. Be this as it may, until suburban residences are built, Malaga will not take the place, its climate entitles it to, as a resort for English sufferers.

Malaga, though eminently a filthy town, especially in its older parts, proves a fairly healthy spot to those born within it. The mortality is small, longevity not uncommon. By the local physicians the climate is held to be enervating, and as unfit for children, as it is adapted to the elderly. Aged persons from the mountains are said to undergo a sort of rejuvenescence within it.

Acute chest affections take a high rank among the causes of death. Of 9049 deaths occurring in ten years in the civil hospital, only 487 were due to phthisis (271 in males, 216 in females), or 5·4 per 100 of the whole number.†

Strangers are often attacked by a painful ulceration at the margin of the gums,—a complaint variously ascribed to the bread, the water, and the wine.

It has not occurred to me to meet with any case of imported phthisis permanently arrested at Malaga; but I have known prolongation of life, and general and local improvement effected by a single winter there, even where the disease had reached the third stage. In these instances the disease was of atonic type: though less irritating than that of Nice or Cannes, the air of Malaga is unsuitable to hæmoptoic and pyrexial cases.

1590. *Lisbon*.—In its medical history Lisbon resembles Pisa: once a very popular winter resort, the capital of Portugal, has

* J. M. Madden, “Change of Climate,” p. 124. Lond. 1846.

† Martinez, “Topograph. Medica de Malaga.” 1850.

fallen into more complete neglect than its climatic imperfections warrant.

Magnificently seated on the Tagus, easily reached from home, provided with well supplied markets, remarkable for animation and bustle, Lisbon will probably prove less foreign to an Englishman, than almost any spot on the continent: numbers of his countrymen are established residents, and his habits are well understood by those who cater for him.

There can be little doubt Lisbon has been ostracised on account of the *uncertainty* of its climate; its abrupt changes from dry to moist, and softly genial to harshly keen. And further, the dry quality seems to predominate one winter, the moist another: so that some writers, who have actually lived in the town, place it among the moist and sedative climates, others among the stimulant and bracing.

The mean winter temperature is returned at 52·5; that of spring at 60. The lowest point reached in sixteen years, was 26°, The diurnal range is considerable, a variation of 20 to 30 degrees being not very uncommon,—while the thermometer has actually been known to fall to freezing point at night, and rise to 67° the following day.

The north and north-east winds seem to be the most common, —they are dry as well as cold, passing over sandy plains *en route* to the town: southerly winds bring rain and dampness. Perfectly calm days are very rare.

Rain falls on an average 35 days in winter, 26 in spring.

The sanitary condition of Lisbon, though greatly improved of late years, still leaves very much to be desired.

The Braganza hotel, standing on a terrace, one hundred feet above the river, and commanding a brilliant view, is recommended as a desirable situation; the upper part of the Val do Pereiro, and (for those preferring a country residence), the neighbourhood of Bemfica, are also selected as fitting spots for invalids.*

The advantages of the brilliancy and temperateness of the Lisbon climate seem more than counterbalanced by the evil of its changeableness. Still, in the dearth of easily accessible winter stations, created last winter (1870-71) by the Franco-Prussian war, I was glad enough to avail myself of the Portuguese town. The patients I sent there (some consumptive in an early stage, others bronchitic), got through the winter well; but their number is too

* Francis, "Change of Climate," p. 125.

small to furnish any general conclusion. Confinement to the house the entire day by rain, had occasionally to be endured.

1591. *Cintra*.—Cintra, about sixteen miles distant from Lisbon, though temperate even in winter, is at that period of the year utterly unsuitable for invalids. Damp, rainy, foggy, and cheerless—singularly so for so southern a latitude—during the cold months, Cintra and its attractions belong wholly to the summer.

SUB-GROUP V.—NORTH AFRICA.

1592. *Egypt*.—The climate of the middle and southern belts of Egypt, the only parts resorted to by the phthisical, is distinguished by clear, steady sunshine, and by extreme dryness. Rain, rare at Cairo,* is very, very seldom seen more to the southward,—though said to be growing more common in consequence of increased cultivation.† This extreme dryness, in some points of view so beneficial, promotes very materially great and sudden diurnal variations of temperature and checks or arrests perspiration,—the cold in turn, severely felt even with the thermometer at 60° Fah., lowers the vital power of delicate patients. From careful observations, kindly made for me by Dr. Siordet, now of Menton, the temperature may be expected from November to March—the invalid's months—to oscillate between a maximum of 85° at 2 p.m., and a minimum of 40° at 9 a.m. The nights and early mornings are habitually cold; a difference of 30° between the highest day- in the shade, and lowest night-temperatures is not uncommon, while it has been known actually to reach 50°.‡ The thermometer has registered in rare instances 25° at night; hoar frost is not excessively uncommon, and ice is occasionally seen south of Cairo,—snow, scarcely south of Alexandria. Dew, not abundant as a rule, is occasionally copious, and damp and fogs follow the recedence of the Nile, and are still prevalent in November and December. Windiness, though by no means unknown, is not one of the habitual evils of Egypt. The dreaded hot sandy wind S.E. by S. (or rather air, for there *may* be but little breeze), the Khamsim, promotes hæmorrhage; and though the patient ought to have taken his departure before its season,

* According to Rhind, on fifteen days and nights rain may be expected to fall between mid-November and mid-April, but in the majority of these the fall is limited to a shower, or even a few drops.

† Patterson, "Egypt and the Nile," 1867.

‡ D. Symonds, "Climate of Egypt." Again, on the last day of December, 1856, writes Dr. Dickinson ("Egypt and Arabia," p. 15; 1858), the maximum temperature in the sun was 110°, the lowest at night 40°, and thus, though the wind was light and southerly.

be will sometimes be caught by it in April and even March,—at least in a subdued form. The large amount of free electricity in the air at the time aids in increasing the discomforts of this enervating and stifling wind. Lightning and thunder are rare.

The dry and genial balmy warmth (even a temperature of 80° south of Cairo, is not sensationally over-high) and the brilliantly clear and sunny atmosphere are the essential merits of Egypt; we have seen, the drawbacks (to which may be added the mosquitos and sand flies) are not a few; and though the condition of the several seasons is very evenly reproduced year after year (much more so than at most southern sanatoria) the resisting power of the invalid will often be rudely tested by unusual states of the atmosphere.* The food, as a rule, is wretchedly bad.†

It is difficult to choose for the best between the Nile-boat voyage and a continued stay at one place, say Cairo, for the season. The boat's discomforts (ill-fitting windows, chinks in the wood-work freely admitting cold draughts, &c., and night exposure) are the bane of the former mode of proceeding; its dreary monotony (once the novelty of Minarets and Moslems is past) makes the latter well-nigh intolerable to many.‡ On the boat the least wind, even with a temperature of 70° in the shade, will call for the use of abundant wraps; and moving clouds of sand, obscuring the light, penetrating everywhere, and almost stifling the traveller, though nestled in bed, are occasionally to be looked for even with a cold wind. The boat-traveller is not unfrequently attacked by hæmoptysis or dysentery,—the latter, Dr. Siordet assures me, may be in great measure prevented by (contrary to the usual custom) anchoring at night. The weaker class of invalids should, I think, avoid the boat, unless the object be to reach Nubia.

* Thus, on the occasional violence of the winds, and severity of the cold, hear the testimony of an American traveller, not the less trustworthy, because its terms are oddly quaint and fantastic. "Still! wha the wild winds puce up and down the Valley of the Nile, like his mad hounds howling for Action; like all the ghosts of all the three hundred dynasties, anterior to history, demanding to live again. . . . Warm? why, the Howaighi sat more voluminously swathed in coats, cloaks, and shawls, than tomummies in their spiced bandages. They began, bravely, with sitting in front of the cabin, warmly wrapped in winter clothes; and, only a little chilly, played that it was summer, and conversed in a feeble, poetic way of the Egyptian climate. Gradually they retreated to the divans in the cabin, and cursed the cold."—"Nile Notes of a Howaighi," by Curtis. I may add, that in February, 1862, there was a storm sufficiently strong in Cairo to tear up trees by the roots; thirteen people were killed on the streets.

† The establishment founded by an enterprising English lady, at Cairo, within the last few months, is likely to be much better catered for than the ordinary hotels.

‡ Yet, on the principle of *non alteram partem*, let us quote Miss Harriet Martineau to an "There are few gayier things in life, for one who chooses to be gay, than a visit to Cairo."

That phthisis is in the highest degree the disease of Upper Egypt and Nubia, especially among those migrating to Lower Egypt, there can be no doubt: I heard this veridically affirmed many years ago by Usser Esp. and later* observed to support him. The causes are probably identical in the main, with those producing a like result in Australia (1861), but, in addition, the more careful examination of the native sex now-a-days, may, as in Bengal, have simply proved the frequent existence of that which had hitherto not been looked for.

But our present concern is with the influence of Egyptian air on phthisical strangers from northern latitudes. It is well† that European plate-layers and engine-drivers on the Suez line are singularly free from pulmonary disease. My own observation would lead me to place phthisical sufferers returned from Egypt in the following classes: (1.) Some who had suffered more or less severely from dyspepsia, dysenteried diarrhoea and anorexia; (2.) Others in whom hæmoptysis had evidently been excited by the climate; (3.) Others, again, who had acquired there dry, irritating and most distressing cough. Nevertheless, in almost every one of the patients belonging to these classes, the *diathetic* state had more or less improved; 4.) Others in whom great general and local improvement had been effected without concurrent evil of any kind; 5.) Lastly, others in whom complete suspension of the disease, maintained for years, and up to the present hour, followed a single winter's sojourn; (6.) I cannot recall any instance in which positive ultimate mischief could be fairly credited to the climate; but in a certain small number of persons Egypt left all the evils it found, and in exactly the state it found them.

Persons prone to any form of ophthalmic disease or to dysenteric irritation should avoid Egypt.

17. *Notes and the Desert.*—If there be any spot on earth to which the phrase "here to breathe is happiness enough;" be fairly applicable, that spot, provided vegetative ecstasy alone be thought of, is Nubia. The excessive dryness, the balmy exhilarating purity of the air; the vividly luminous brilliancy of the sun-light contrasting with the sombre clearness of the starlit nights; the more equable temperature from day to night than in Upper Egypt; § the stilly repose of life, which infects the invalid with its

* Patterson, loc. cit.

† Patterson, loc. cit., p. 42.

‡ Usser Esp. was originally, but also too partially, applied to Cambray.

§ The highest temperature, when it rises reaches 70°, rarely falls below 50°.

own placid calmness and makes him for the time as careless, as he is incognizant, of the world of civilization beyond, give to a sojourn in Nubia a singular and exquisite charm.

The Nubians enjoy very superior health to that of the Egyptians, even of the upper belt. The gaiety and comparative robustness of the children strike the traveller at once; no flies are seen feeding upon diseased eyes.* Phthisis is incontestably rare, though not unknown among them on their own soil [1527, *k*]; true, if transported to Lower Egypt and the Delta, Nubians rapidly perish of it in large proportion. Whether their home-immunity is solely climatic, or may be in any degree traceable to their national habit of anointing themselves with castor-oil, is a question open to discussion.

The plan for a winter-stay in Nubia may be sketched as follows. The patient should land at Alexandria the first week in November (October may advantageously have been spent at Malta); proceed at once to Cairo; † remain here no longer than to allow of his reaching Thebes in December; arrive on Nubian ground the first week in January; linger there till towards the end of February; drop homeward down the river as far as Cairo by the middle of March, and leave Egypt the first week in April at the latest.

If the climate of Nubia were not too hot for prolonged annual stay, more might be expected from its influence on the phthisical diathesis, as it seems to me, than from any hitherto tried locality. If it were given to any association of climatic conditions, exclusive of low barometric pressure, to stamp out the tuberculous evil from a northern constitution, Nubia, I believe, might lay the strongest claim to the possession of the marvellous combination.

1594. *Algiers*.—Sloping gently to the sea; enjoying a mean winter and spring temperature which may be practically fixed at 62° to 64°; ‡ almost rivalling Madeira in the smallness of the diurnal variations of the thermometer; intensely, too intensely, bright and luminous; rarely foggy; very slightly dewy, except at night; remarkable for the largeness of its quasi-tropical rain-fall in proportion to the small number of wet days,—the resulting torrents drying up almost at once from the combined influence of

* "Nile Notes of a Howadji," p. 123.

† Patients cannot be too strongly cautioned against unnecessary delay at Alexandria: its intensely moist atmosphere (Fruer makes it 152 times moister than that of Cairo—"Topographie Méd. de Cairo"), and the chances of getting dysentery, should warn him off this ground. Curiously enough Celsus (*lib. ix. c. 22*) recommends Alexandria to Italian phthisical patients on account of the "density" of its air.

‡ In some places the means are given lower than this: Francis (*op. cit.*) assigning 54° as the winter, 60.5° as the spring temperature.

rapid evaporation and the slope of the site; exposed to all winds,—the north cold and dry,—even the south refrigerated in winter by the Atlas snows; sometimes displaying ice in the pools; with excessive rarity visited by snow; well provided with hotel and other accommodation; attractive in itself and in its surroundings from the singular mixture of African and European modes of life, of French vivacity and Oriental indolence,—the city of Algiers, despite its rain and occasionally moist atmosphere, belongs, on the whole, rather to the stimulant group of climates than to the sedative.*

Algiers, looking north, and seated in a warmer latitude than any of the European Sanitaria, aptly illustrates the truth, when compared with several of the spots on the two *Riviera*, that good protection from the north balances the influence of notable superiority of latitude. For, sensationally, patients suffer quite as much from cold as at various north-Mediterranean places of resort.†

The eastern suburb, Mustapha Supérieur, is the most desirable spot for a winter stay.

The mortality from phthisis is small in the Algerine mixed population, both native and foreign,—the calculation having been made that 1 of 28 deaths from all causes figures as phthisical, while in London, for example, the ratio stands as 1 : 8.‡ But this result (though supported by the fact, that in all the stations of Algeria, the French army suffers less from phthisis than at home),§ scarcely warrants the sanguine hopefulness with which, in years gone by, M. Costellat urged on the French Government the importance of establishing a phthisical Sanitarium in the colony.¶ My own limited experience is of chequered significance : I have had patients to whom the climate-influence proved obviously injurious and hastened the end; in others, a *status in quo* was maintained, which could not have been expected at home; and, again, I have known the disease held at bay year after year by sojourn at Mustapha,—but in this, a single, instance, there seems to be an intrinsic tendency to inactivity of all morbid processes.

1595. *Tangiers*.—Little is known of Tangiers climatically. The

* It is, however, certain that to some English people, both consumptive and healthy, the climate proves sensationally relaxing and depressing as compared, for instance, with those of Cannes and Hyères.

† Dr H. Bennett (*op. cit.*, p. 47) believes he can furnish "conclusive evidence that vegetation suffers more from the influence of winter at Algiers than in the Genoese Undercliff."

‡ Mitchell, *Medico-Chirurgical Review*.

§ Roeland, *Mém. de l'Académie de Méd.* t. xx p. 157

¶ "Influence du Climat d'Alger," &c., *Journ. des Connaiss. Méd. Chir.* 1857.

town, seated on a hill, in amphitheatre-like form, is exposed to cold north-west winds from the Atlantic, but the thermometer rarely falls below 40° in winter; rain falls with tropical violence in October and November. There is good hotel accommodation, and both the meat and its cooking are reported to be very much better than in some first-class towns of Spain.

It appears to me it would be quite justifiable to allow a phthisical sufferer to repair to Tangiers for the winter, if considerations, independent of health, made it a desirable place.

1596. *Mogador*.—So, too, Mogador might be safely utilised, as it actually has been in my experience, under similar circumstances. This important town, seated on a low sandy shore, has a considerable number of European residents, and supplies of various articles of food are constantly landed from England, with which there is an active trade. Fresh provisions on the spot are represented as being remarkably good.

1597. Doubtless there are, besides, many spots in North Africa of climatic qualities sufficiently admirable to entitle them at least to a trial. If Mr. Urquhart may be believed,* Larache, a short two days' journey from Tangiers, "sheltered from the sea (though inhaling its breath and freshness) and from the damp wind that infests its shores of Spain and Morocco . . . with the latitude of Madeira, without its storms or sudden changes," possesses qualities of this stamp. But the want of the comforts of European civilisation, and the pugnacious religious enthusiasm of the natives (or fanaticism, as we are bound to call it, for the religion is not our own) make these untried localities unsuitable for English invalids. And so we go on, clinging to so-called Sanitaria nearer home, which have been judged and found wanting,—not one of the whole number even approaching perfection.

1598. *Canary Islands*.—Teneriffe† is the only one of this group of islands hitherto, as far as I know, utilised by invalids, and even this but to a very small extent. Very notably drier, and somewhat hotter, than Madeira, the towns of Santa Cruz or Orotava might be tried, where English comforts are of less importance than a dry steady heat. The mean winter temperature of Santa Cruz averages nearly 65° Fah. or about 26° degrees higher than London.

From information derived from residents I should think Las Palmas, in the Great Canary, is probably the most promising locality in the islands.

* "Pillars of Hercules," by D. Urquhart, M.P., vol. ii.

† *Pinkerton, Monthly Journal*, 1854.

SUB GROUP VI.—SOUTH AFRICA.

1590. *Cape Town* commends itself to the attention of English sufferers as ground of their own. The capital of our possessions in South Africa, it stands on the shore of Table Bay, and at the foot of Table Mount, which, rising to an altitude of about 3570 feet, exercises a well-defined influence on the meteorology of the district.

Cape Town, like the surrounding country, is remarkable for the dryness of its atmosphere, whence the plague of dust in the streets. The mean moisture of the air for ten years, saturation being 100, stands at 81.7 for the three winter months, 70 for those of spring. Exposed to the full glare of the sun and played on by reflected heat from the naked walls of the mountain behind, the town is, sensationally, very, sometimes almost unbearably, hot. The mean thermometric winter temperature (that is from June to August inclusive) has been given at 62.3; that of the three following spring months at 63°,—an example of very singular equality.*

The north wind, cold, blustery, and rainy, is very common in winter. The south wind, bearing much moisture with it, prevails in spring, and produces a peculiar fog on Table Mountain (familiarily known as the Table-cloth), the occurrence of which portends rain and cloud, sudden fall of the thermometer, and a change from dry to damp weather. Thunder-storms are of tolerably frequent occurrence, and shocks of earthquake not unknown. In summer the south-east wind is violent, and carries much dust with it.

The Army Reports show that lung-affections are rare among our troops in the colony generally,—while pulmonary consumption is less fatal among them than at any colonial station except the East Indies. Consumption is said to be frequent among the Hottentots.

The food is good at the Cape; the habits sufficiently those of the home-country; the invalid moves among people of his own race;—circumstances which, in the eyes of many, would increase the desirability of trying the climate. My experience of the influ-

* This is the average printed by Clark (op. cit. p. 342); and is said to be derived from seven years' records. The very elaborate observations made at the Cape Town Observatory in 1858, give, however, very different means for winter 54.4; for spring 65.9. Somehow this looks more like probability. Meanwhile these varying returns show how little confidence is to be reposed in thermometric averages. Another version is given by Dr. Mann ("The Colony of Natal"); the mean winter temperature of Cape Town standing at 57.2 from fourteen years' observations, according to his statement.

ence of Cape Town is on the whole favourable; and, although it is not a place to which one is disposed very readily to send phthisical sufferers on account of the distance from home, I have in the course of years had a fair number under observation, who have passed six or seven months there, and in no instance (save where the disease was very much advanced) have I known positive mischief arise from the climate.

Rondebusch, *Newlands*, and *Wynberg*, villages lying to the north of Table Mountain, are free from the dust and wind of, and are much more eligible sites (especially during the hot months) than, the town itself, from which they are distant from four to eight miles.

The singular dryness, purity, and balmy exhilarating quality of the air of *Bloemfontein*, in the Free State, makes it a still more desirable destination, if the patient be sufficiently strong to bear the necessary rough waggon-journey, and cares nought that he there lives among foreigners.

The sea-voyage, despite the drawback of the equatorial heats, proves, as a rule, highly beneficial.

1600. *Natal*.—The colony of Natal occupies a littoral tract of South-Eastern Africa, facing the Indian ocean, and reaching a maximum length from north to south of about 250 miles, by a breadth of about 130. The land rises from the sea by a sharp gradient of about 1 in 70 (the slope being interrupted by a series of terraces, intersected by deep ravines) to a height of about 5000 feet. The colony contains two towns of importance,—Durban, close to the sea, and Pietermaritzburg, about 2090 feet above its level. To the latter and its immediate surroundings the following observations will mainly refer.

Sunniness is one of the striking characters of the winter climate; and the shortest day in the year has ten hours' sunlight; while the longest has only fourteen [1524, *note*]. Singularly enough, very little rain falls in winter (the average rain-fall for the two mid-winter months, June and July, at Maritzburg, being only $\frac{1}{4}$ of an inch for each),* while in summer rain and cloud are abundant enough: the total annual fall averages 30 inches. Thunder-storms are frequent; hail-storms, with masses of ice occasionally weighing three-quarters of a pound,† are not uncommon summer visitors.

The mean temperature of the winter half year at Maritzburg stands at 60°, that of the summer at 64·7°. The diurnal range, in winter especially, is considerable,—a result of the bright sunshine

* Mann, "Climate of Natal," p. 12.

† Scoresby Jackson, *op. cit.*, p. 196.

by day, and the easy radiation into the peculiarly clear and starry sky at night. Actual frost has only been detected five times in eight years by self-registering instruments at Maritzburg.

Resident practitioners consider the coast region the most fitting part of the colony in the dry winter season, especially in cases accompanied with dry cough,—the hilly country during the wet warm summer, especially for the converse class of patients.

The natives are affected to a very limited extent by phthisis; Mr. Taylor of Durban states he has only known of three cases in seventeen years.* This is to us, however, a matter of secondary importance. Some very decisive evidence, on a fairly large scale too, from numerous local medical men, establishing that the diathetic state, as well as the local mischiefs and certain of the intercurrent evils of the disease—hæmoptysis, for instance—are perceptibly benefited by sojourn at Natal in *imported* cases, is the form of fact that really concerns us. The limited experience I have had of the climate prepares me to accept as unexaggerated the favourable statements reaching us from the colony itself. In one of the most remarkable instances I have known, of complete suspension of (hæmoptoic) phthisis and restoration to hopeful and energetic life, the recovery took place at Maritzburg.

Unless the voyage be the essential element in the invalid's programme, or unless he be prepared, on the other hand, to remain in the colony for some years, the great distance of Natal from home puts it out of the pale of places for selection. It seems a region peculiarly suitable to consumptive youths of the business-classes, who, unable to fight their way at home, might find within it many openings for steady moderate exertion, such as the genial climate would in all probability give them strength to undertake.

1601. *South African Desert*.—The impunity with which delicate travellers pass months under tents and in wagons in the desert, is as striking as the fact is unquestionable. I had a phthisical patient under occasional observation for the last three or four years of his life, who, ten years before I made his acquaintance, had been pronounced by a practised auscultator to have a cavity in one lung. Possessed of ample means, this patient had searched both hemispheres for the *true climatic asylum*. That he was able to wander about in all directions, and that he had so long survived destruction of some of his lung-substance, sufficiently prove that he belonged to the category of sufferers in whom the disease from some intrinsic cause is disposed to run a slow course. This fact

* Mann, loc. cit., p. 5.

does not, however, lessen the practical value of his conviction, that, of all the spots, civilized and uncivilized, he had essayed, none had so thoroughly agreed as the South African Desert. The Desert in all its realities: shooting one's daily dinner, and sleeping under the protection of canvas alone. The only drawback was the isolation,—the separation from relations and all social refinement. He was *en route* once more for his favourite haunt, when an accidental attack of inflammation proved too much for lungs riddled with cavities, consolidated and breaking up,—and he perished.

SUB-GROUP VII.—AUSTRALIA.

1602. *Victoria* is the only portion of the Australian continent which has, as yet, been steadily put in requisition by British practitioners as a temporary or permanent place of exile for consumptive persons. Whether the adoption of Melbourne arose from the general home-impression of the infrequency of phthisis in the colony or not, certain it is, that impression did prevail. It was supported by the statistics collected from local records by an English, and therefore, dispassionate, witness, Dr. Beddoe: and there is not the smallest reason to doubt, that, at the time they were issued, his results accurately represented the real state of things. But it would seem from the more recent enquiries of a resident observer, Mr. W. Thompson,* that phthisis is steadily and seriously on the increase, at least in Melbourne and its suburbs; for, while the disease furnished 2·08 deaths per 1000 of the population in 1866, the proportion had since risen to 2·52 in 1869. This increase in the amount of destruction by phthisis, it seems to me, probably depends on the growing difficulty of the struggle for existence in the colony, and the gradual assimilation of colonial habits and occupations to those of the mother country,—the gradual approximation to the great town system,—whereby the superior qualities of the climate, as originally experienced, have gradually been nullified. The powerful influence of mode of life is best shown, when of different races inhabiting the same region, and living under the same air, some are decimated by phthisis, and others escape it wholly, or almost wholly. Thus in Peru, phthisis destroys the Negroes most extensively; next the descendants of the original Spanish occupants of the soil; next, the half-castes; next, imported Europeans; while the Indians escape almost com-

* On Phthisis, &c., 1870, p. 43.

pletely. These differences have been well traced by Guibert to difference of mode of life.*

From our present point of view this is, however, a matter of secondary importance; neither would the fact (if fact it be), that phthisis, developed in the colony, runs a course as rapid, as in European towns, in this aspect carry with it grave significance. Our business lies with the influence of the climate on immigrants already phthisical at the time of their arrival. Information, at once precise and extensive, on this head, has yet to be supplied. I have had authoritative tidings of but few patients permanently expatriated in the colony: still absolute arrest of the disease has, to my knowledge, occurred in some few, under the most disastrous antecedents. And, further, in many, many instances of brief stay ashore, and return to Great Britain, very sensible improvement has followed,—true, the voyage may be credited with at least a goodly share of the result achieved. I am thoroughly satisfied, too, that favourable effects would be more frequent, if due caution were used by the patient in choosing his places of sojourn. Dr. Dongan Bird, who has now practised for many years in Melbourne, “most unhesitatingly affirms, that he has seen more cases of absolute recovery from tubercular disease of the lungs in any one year of his residence in that colony, than he ever *heard of* in Europe.”†

The coast should be avoided at certain seasons,—and inland towns or settlements resorted to. The three hottest months of the year (December, January, and February), would be with advantage spent in Tasmania,—say, the neighbourhood of Hobart Town.

I can very positively state from actual knowledge, that in the third stage of the disease, and with general accompaniments of the gravest import, complete restoration to health and active vigorous life may be accomplished under the influence of the climate of Victoria. On the other hand, I have certainly known the influence fail, where the condition of the sufferer seemed singularly propitious [1527, c]. There are, unfortunately, no records to show what the proportion is of those in whom the disease undergoes arrest, or advances on its steady course to death.

Sydney.—Sydney, too, is not a bad place for adoption during the winter months,—while the summer could be spent with

* *Phthisie Pulmonaire*, p. 20. Paris, 1862.

† *Dongan's Reports*, vol. ii. p. 480. 1871.

with advantage at Goulburn, or other inland spots at a certain altitude above the level of the sea.

SUB-GROUP VIII.—TASMANIA.

1603. *Hobart Town*.—The mean winter temperature of Hobart Town has been estimated at about 42·25, that of spring at 53 : the former is slightly lower, the latter slightly higher, than that of Cove, Penzance, and Torquay. Besides, the atmospheric changes are sudden, frequent, and violent.

Mr. Scott, Surgeon to the Colonial Hospital, considers the climate too variable for phthysical patients,* but the proportion of cases of consumption, probably acquired in the colony, appears to be lower than in the British colonies generally.†

Hobart Town will probably prove chiefly available as a place of escape, during the summer months (the mean temperature is only 63°), from the intense heat of Victoria and Sydney ; in point of fact, its claims in this aspect are of the strongest.

SUB-GROUP IX.—NEW ZEALAND.

1604. Of the three islands forming the New Zealand group, the northern seems to hold out the best prospects to the pulmonary invalid ; and although Nelson and New Plymouth on the western coast are said to be softer and milder than Auckland and Wellington on the eastern,‡ Auckland appears on the whole to be the most appropriate spot.

1605. *Auckland*.—The mean winter temperature at Auckland stands at 50·68 ; that of spring at 56·82 ; that of summer at 66·38 ; and that of autumn at 59·82.§ The air is said to be soft, buoyant, and exhilarating. The temperature is very certainly remarkable for uniformity, when set in comparison with that of the Mediterranean Sanitaria ; though it is materially more variable than that of such exceptional spots as Bogotà [1612]. A phthysical patient will very constantly be able to take exercise in the open air,—the winter being not unlike May and June in England.|| The principal danger seems to be the sudden and great fall of temperature at sunset : the diurnal range, in truth, appears, for so

* Trans. Prov. Assoc., vol. iii., 1855.

† Clark, "On Climate," p. 353.

‡ Duffenbach, "Travels in New Zealand," 1843.

§ Johnson, quoted by Clark, *op. cit.*, p. 359. A gentleman, who had taken careful daily observations for two years at Auckland, lately told me he had never known the thermometer rise above 80° or fall below 45°.

|| R. Tassell, M.D., in Dobell's Reports, vol. ii., p. 79. 1871.

equable a climate, to be very considerable. Besides, though less blowy than Wellington, the district is not free from occasional troublesome visitations of boisterous winds.

The Maoris fall victims to phthisis very extensively. Their proclivity to the disease has been supposed to depend on: (1) their progenitors having originally immigrated from the tropics, (2) their living in huts "worse than dog-kennels," (3) their wearing woollen covering, often saturated with wet, day and night, and (4) their sleeping on the damp earth.* The use of potato diet for 300 days in every year is also presumed to play an important part; but as a large proportion of the rural Irish population feeds on potatoes 345 days in every year, while the natives of the "green isle," have never been proved to be specially phthisical, the reality of this influence may be questioned.

Dr. Tassell has "not seen or heard of a single case of phthisis as having arisen among the European population:" he does not, however, say in what length of time.

There can be little doubt that in the early conditions of phthisis, the climate of Auckland would afford a better chance of restoration to health than that of home: and the opportunities afforded for recommending active life in a young colony, is a feature deserving consideration.

GROUP III.—CLIMATES WITH AN ATMOSPHERE ADVENTITIOUSLY INTERESTED.

SUB-GROUP I.—MALARIAL.

1606. *Pozzuoli*.—"Beautiful, benign Campania," is reputed to furnish no contingent to the list of Italian pulmonary sanatoria. And yet, there are two places on the western shore of the Bay of Naples,—one, a relic of the past, *Itana*; † the other, a half-runned but picturesque town of the present, *Pozzuoli*,—which for a special reason, indicated by their appearing in the present sub-group, may grow into future importance. Both are said to possess a peculiarly soft, humid atmosphere,—so calm, that the breezes scarcely ever fan it into motion. Both are malarious: the former powerfully (the inhabitants displaying all the characteristics of paludal cachexia), the latter slightly. The drinking-water, slightly sulphurous, is reported to possess medicinal virtues. Though so close to Naples,

* Thompson and Kemp in Dobell's Reports, vol. ii. p. 72.

† The beauty of the site has not fallen off, since Horace sang its praises in the line—

"Nullus in orbe annis Baia proleat amara."

the mean winter temperature of Pozzuoli slightly exceeds that of the Neapolitan spring.

The intense insalubrity of Baia, interferes with its employment; but the claims of Pozzuoli, as a winter sojourn for the phthisical, have been strongly advocated by MM. de Renzi and Carrière.* The latter marvels that Pozzuoli, "assuredly possessed of a milder winter than any other station in Italy," has so long been neglected by medical art. Not only does the climate favourably modify the symptoms of phthisis, according to these observers, especially when accompanied with an irritable state of the mucous surfaces, but it actually removes those symptoms altogether.

The efficacy of the air of Pozzuoli seems so remarkable to M. de Renzi, that its soft warmth cannot alone explain the influence; and he suggests that the mingled sulphur-vapour † may play the part of "balsamic remedies" in regard of the pulmonary apparatus. M. Carrière justly objects that volcanic emanations, such as pervade the local atmosphere, must be of complex nature, and that a single form of them cannot logically be selected as the probable cause of the observed effects.

May it not be much more reasonable to suppose, that the paludal emanations of the soil are the real cause of the influence observed,—that the condition of blood and nerve in the malariously poisoned system interferes with the oxidising processes of destruction essential to phthisis? It is certain the ordinary effects of malarial poison do not exhibit themselves in tuberculous persons sent to Pozzuoli, though the healthy are immediately affected: the activity of the poison is directed into a new channel.

1607. Of the antagonizing power of malaria over the *generation* of phthisis no doubt can, I think, be fairly entertained [1282, c], and the reality of its *curative* influence over the actually developed disease has long been more than surmised. The astute sceptic, Volney (a man not likely to accept chimeras with favour) records that consumptive Europeans at Aleppo were sent to the sea-coast, where grave intermittents prevailed, for the recovery of their health; Dr. Wells, who quotes the statement, gives similar evidence from parts of England, the Netherlands, and Portugal.‡ Dr. Green shows that phthisical patients coming to Whitehall, an excessively marshy district, undergo great and sustained improvement.§

* *Op. cit.*, p. 221-224.

† Galen sent phthisical patients to Stabia, between Sorrento and Naples, to breathe the sulphurous air from Vesuvius.

‡ *Trans. of a Society, &c.* (*loc. cit.*), p. 409.

§ *Report on Sickness in U. S. Army*, 1840.

Spallanzani found in Sicily that young persons, threatened with consumption, were taken to malarious districts as the acknowledged best remedial measure.* Crozant relates in great detail four cases of phthisis, arrested by prolonged stay amid the marshes of Nièvre.† And additional strong evidence of the same kind is to be found in the special volume of Tribe.‡

Of the accommodation at Pozzuoli much cannot be said; and obviously, companions and attendants had best be acclimatized people,—though the dangers would be comparatively slight, as the consumptive patient's period of sojourn would be exempt from active malarial disease.

SUB-GROUP II.—RESINOUS AND BALSAMIC.

1608. *Arcachon*.—The prosperity of Arcachon, as a sanative resort, dates from 1854, when the fortunes of the place were taken under the protection of some Paris speculators: for, though the merits of its peculiar atmosphere had been urgently, and, it must be admitted, very intelligently, advocated by M. Pereyra in 1843.§ votaries at its shrine continued few and far between, until the joint-stock principle added the monetary to the scientific impulse.

Arcachon, about thirty miles from Bordeaux by railway, occupies a site on the margin of a vast lake-like expanse of water communicating by a short, narrow channel, twelve miles by one, with the Bay of Biscay. Sand-hills of moderate elevation, thickly planted with pines, constitute the essential feature of the scenery. Within these pine-forests rise a certain number of bungalow-like villas, or *châteaux*, for the winter reception of invalids. Many of these tenements are confessedly so ill built, that their interior is more trying to an invalid than the open air.||

The pine-forest protects the little colony from the west, the south-west, the south, south-east and east,—especially breaking the force of the west wind from the Atlantic. It may also, to a certain extent, render sudden changes in temperature less perceptible. The atmosphere is humid; rain, in winter, frequent and enduring: the soil, fortunately, rapidly absorbs moisture.

The balsamic emanations from the pines, which are constantly under the action of the knife for the purpose of obtaining their

* Boulin, *op. cit.*, p. 59.

† *Journal de Méd.*, Mai, 1844.

‡ De l'heureuse influence des pays marécageux sur la tuberculization pulmonaire.

1843

§ *Traitement de la Phthise Pulmonaire*, 1843.

|| E. Hameau, "Le Climat d'Arcachon," p. 9. Bordeaux, 1866.

resinous material, give the specific quality to the atmosphere. Now the curative virtue of these emanations is matter of very ancient faith. The old Romans sent patients "with ulcerated lungs to Libya, where by breathing the balsamic effluvia of the pines, with which that country abounded, they are said to have lived many years in safety from their complaints." *

The constant inhalation of these emanations appears to generate a *minus* state of nervous and general vital activity. The pine-cutter is of small stature, thin, of bronzed tint of skin, and "bilious"; while any illness he may have is sure to wear a sub-acute quasi-adyamic character. In accordance with this M. Hameau finds that the action of the air in phthisis is sedative, and only proves beneficial in cases marked by nervous erethism. In cases of this class the good, the balsamic air has achieved, may, as he states he has frequently witnessed, be totally annulled by exposure during a short stroll to the exciting marine air of the beach,—that kind of air, which many, from the days of Aretæus to those of Laennec, have believed so essentially curative!

Various attempts have been made to explain the sedative influence of the atmosphere of pine-forests. M. Marchel ascribes it to the lowering influence of the terebinthinate vapour constantly floating in the air; others to the disoxygenation of the air by this vapour; others to the action of resinous aromata, &c.

These hypotheses are, however, of little consequence; our real point is the climatic influence of the spot on imported phthisis. On this branch of the subject M. Hameau supplies evidence most conscientiously and carefully drawn up: were his model imitated in the various sanatoria, we should soon be enabled to predicate with a certain amount of surety the probable influence of all on the course and issue of the disease. For details the reader must refer to the original pamphlet, and content himself here with the following statement of M. Hameau's main results:—Of 100 cases of phthisis, French and foreign, treated between 1854 and 1865, 36 died,—17 in, 19 out of, Arcachon. In 110 cases the influence of a stay, varying in duration from between one and two months to nine years, was shown thus: cure in 8; improvement in 15; aggravation of the disease in 12; a calming effect on the symptoms in 42; no effect *pro* or *con*. in 33,—of which 33, it is essential to note, 28 only made a flying stay of from one to two months: the stay may have been shortened, however, in consequence of the ascertained unsuitableness of the climate.

* Gilchrist, "Sea Voyages in Medicine," p. 69.

1609. *Bournemouth*.—The valley of the Bourne stretches inland from the sea in a north-westerly direction. At the mouth of the stream, and strutting the cliffs which rise on its eastern and western aspects, are built the villas devoted to the winter reception of invalids at Bournemouth. These cliffs are rich even in the depth of winter with green arborescence,—Scotch firs and other evergreens forming a permanent feature of the landscape.

Protected somewhat from the direct north and north-east winds, Bournemouth is exposed to those from the south-west and south-east. In the spring the east wind, so baneful along the south-east coast generally, is often felt with cutting blast and attendant fog,—but it is less bitter than at many other stations, and resort may be had to the pine-woods for protection.

The sandy and porous soil absorbs moisture rapidly; so that walking exercise may be taken soon after rain, and there is but little of the raw damp feel in the air commonly so disagreeable on our humid shores.

Bournemouth is for gloomy England a bright and sunshiny place. The air seems to warm, and the landscape to brighten, earlier in the morning than at other places along the coast.

It may be calculated from a table founded on seven years' observations,* that the mean temperature, from October to March inclusive, will mark about 44.5° ; that the diurnal range will average 13° ; the humidity 83; and the rainfall amount to 17.2 inches.

The warmth of Bournemouth, such as it is, is not due to the protection of any lofty cliffs, but results from the general configuration of the district. The rainfall is less than in the surrounding country,—again, very notably less than at Torquay and Penzance, but slightly higher than at Hastings.

The scattered pine-woods, however, supply the special attraction of Bournemouth as a winter, and especially a spring, resort. They secure beneficially protected ground for exercise; and their odorous balsamic atmosphere, though feeble, may be supposed to exercise, in a tempered fashion, the same kind of influence as that observable at Arcachon: hence the air is at once dry and sedative.

Bournemouth is an attractive place: many persons, sent there for health's sake, have remained as permanent residents. Its amusements are few or none; but the facilities for exercise of all kinds, varied and great.

* Bournemouth Guide, p. 25. The chief particulars were derived from observations most elaborately taken by Dr. Fells.

The adjacent village of Parkstone is very advantageously situated.

1610. *Isla de los Pinos*.—The Island of Pines, lying south of Cuba, is a favourite place of resort for Cuban chest-invalids, and appears also to be utilized by the practitioners of the United States. Its pine-trees are on a magnificent scale, and the great warmth promotes the free exhalation of their aroma. But I am uncertain to what extent the high sanative repute of the island is referred by the local medical men to the pines. There are mineral waters of supposed efficacy.

GROUP IV.—CLIMATES DERIVING SPECIALTY OF CHARACTER FROM THEIR ALTITUDE ABOVE THE SEA-LEVEL.

1611. We have already seen that the lungs of the inhabitants of elevated sites are normally distinguished by their massive bulk, and the large dimensions of their air-cells [1036], while weighty evidence shows that, with exceptions so few as to leave the rule in essence intact, the lungs seem increasingly inapt to take on tuberculizing action in a direct, but irregular, ratio with the increasing altitude above the sea-level. We have also seen that this form of immunity does not extend to the tuberculous diathesis, but simply modifies this in its attraction towards the lung-tissue [1302, 6].

Our present question is, do the combined conditions making up the climate of high altitudes favourably modify the course of phthisis developed in the plains below? Now it still holds true, as I wrote in 1863, the effect of rarefied, and at the same time warm, air has scarcely been tried as yet on European consumptive sufferers. But it is certain that from time immemorial Peruvian practitioners have habitually sent people who became phthisical on the littoral region, at Lima and elsewhere, to Arequipa, Rondos, Huariaca, Zarma, Canta, Matucana, Huanuco and Jauja, places varying in elevation from 5,000 to nearly 11,000 feet above the sea-level. The popular faith in this "mountain-cure" is unbounded; and I have frequently found in conversation with Chilians and Peruvians, that they look upon it as the very grammar of phthisical therapeutics. And that enlargement of the capacity of the chest follows the habitation of these elevated districts, in persons removing from the sea-level, seems as certain, as that their native population possess a thoracic development ranging considerably above the average of those abidingly exposed to high barometric pressure.

Corroborative statements by lay English writers might be quoted: * it is more to the point that so far back as 1840† Dr. Arch. Smith, who long practised in Peru, announced his conviction of the efficacy of the mountain-sojourn, and justified his creed by a detail of facts. Very lately Guilbert‡ has reported six cases of cure, two of the number French (one of these himself), by sojourn in these Andine heights. Yet more recently Dr. Weber has added one or two more European cases to the list.§ As for the Peruvians themselves, Dr. Fuentes states in the "General Statistics" of Lima that "the proportion between the *cured* and the *total* number of patients in all stages of pulmonary consumption, east of Lima, amounts to 79·5 per 100."¶ The Government has founded an hospital on the spot for the reception of phthisical patients from the littoral regions.

1612. There is evidently quite enough to warrant us in recommending a trial, where collateral circumstances are favourable, of some of these Andine valleys,—or, as more easily accessible, of the plateau of Santa Fe de Bogotá, in New Granada. A gentleman, aged about thirty, whose sister I had seen within a few days of her death from phthisis, came under my notice with excruciating costal pain, and commencing breakage of the other, in a state of extreme emaciation and weakness; the combination of local and general symptoms was besides of grave import,—and my observation, founded in some measure on the manner of his sister's fate, was, he could not live more than a very few months. A continental appointment offered itself at Bogotá: from some previous experience of the climate I recommended its acceptance. He went; and I saw him in London again in 1870 (some four years later), practically speaking well: healthy looking, firmly fat, free from symptoms of any kind, the chest distinctly *nutrified*, and, with the exception of weak breathing and very slight want of tone under exertion, no single physical sign to be detected.

Bogotá possesses probably one of the most equable climates in the world: the mean annual temperature is 15·0 centigrade; that of winter 15·1: that of spring 15·3: that of summer 15·3; that of autumn 14·5.¶

1613. In choosing a mountain-sojourn, too great altitude, with its possible *acclima* [1210], should be avoided. Dr. Archibald

* Burton, "Adventures in Mexico."

† *Edinb. Med. and Surg. Journal*, vol. li, p. 12. July, 1840.

‡ *Illustrated London News*.

§ *Med. Chron. France*, *semaine*, 1909.

¶ Quoted by Dr. A. Smith, *Trans. Jour. Med. Soc.*, vol. vi, p. 355. 1869.

¶ *ibid.*, *op. cit.*, p. 41.

Smith, in imitation of the Peruvian practice, wisely insists on the importance of selecting the "*temperate*" recesses among the hills,—and thinks from 5,000 to 10,000 feet the safest elevation. Extreme dryness, as at Huanuco, is a very advantageous adjunct. Raw cold is to be shunned: the mining district of Cerro Pasco, as other localities near the snow-line, is "unfavourable to recovery from phthisis."* Dr. Smith shows that no regular law of decrease of temperature for increase of elevation obtains in the Andes.†

The same faith holds at the opposite shores of South America. At Rio Janeiro phthisical patients (who are said to abound in Brazil) are habitually sent to mountain-sites, Morro-Queimado, Cantagallo and others in the neighbourhood, apparently with very satisfactory results.‡

And I would desire to draw attention to the claims of *San Paulo* as a residence for pulmonary invalids, where they may pass both summer and winter with advantage. Seated forty miles inland from the port of Santos, 2,300 feet above the sea-level, San Paulo enjoys a dry exhilarating atmosphere, bracing by comparison with that of the littoral regions. The rainfall, considerable in summer, is very slight in winter. As a rule the temperature is equable,—yet such an extraordinary range as from 24° Fah. to 70° Fah. has been known to occur in twenty-four hours. Be this as it will, the genial equality of temperature, which habitually prevails, is sufficiently shown by the fact, that windows and doors are, as a rule, kept open day and night, and the patient may be said practically to live in the open air.

I have known complete physical restoration accomplished by a twenty months' residence here, in a patient one of whose apices had softened pretty extensively at the time of his arrival, and whose disease, both locally and generally, had advanced at Menton.

Again, the elevated table lands of the Pacific slope of Tropical America, and especially of Guatemala, a city seated 5000 feet above the sea-level, with a mean temperature of 66° Fah., are strongly recommended from personal experience by Dr. J. Wynne.§

1614. A proceeding of a very different stamp in reality from

* A. Smith, B. and F. Med. Chir. Rev., Oct. 1856.

† Dub. Jour. Med. Sc., loc. cit., p. 340.

‡ Signol, "Climat du Brésil." Paris, 1844.

§ Proceedings Med. Chir. Soc., p. 368. 1871.

removal to a Peruvian or Brazilian height, though having a certain affinity thereto in seeming, has of late been advocated by some observers,* and, as a startling, quasi-sensational novelty in climatic therapeutics, has suddenly become famous. I mean the adoption by pulmonary sufferers of certain Alpine villages, as places of winter resort. Of these villages St. Moritz seems to be the *facile princeps*.

St. Moritz.—St. Moritz, seated in the Upper Engadine, 6100 feet above the sea-level, and sheltered after a fashion by adjacent peaks from the N. and N.W. blasts, consists of the village proper, execrably ill-drained,† and of the Kurhaus, 300 feet lower down, built on wooden piles driven into the marshy soil, and enveloped each morning in clouds of mist. The starveling blades of scanty grass (which make the summer herbage), of ill-conditioned yellow colour, may be said to wear the livery of the contiguous bog. The intensity of the winter cold may be imagined from the fact that 6.5° Fah. has occasionally been the *average* minimum, and 22.1° Fah., the *average* maximum of a month. Again, in fourteen months of winter (7 in 1866-7, 7 in 1867-8) there were only 15 "clear days," while 148 rainy days, and others "more than half clear" with their admixture of snow, sleet, and rain, made up the rest.‡ Even in August the thermometer may fall to 33° Fah., and snow may appear in any month of the year.

Of the life-giving qualities of the air of St. Moritz in certain forms of nervous exhaustion, &c., no doubt can be entertained. But, whether it be desirable consumptive sufferers should be exposed to the rude influences of its winter climate, because atmospheric pressure is low at the spot and cold plays the part of a bracing agent, is a question to be decided by experience alone,—decided when sufferers in sufficient number, whose idiosyncrasy is *cold-loving*, shall have been persuaded to pass through the necessary ordeal. I have known an instance or two in which patients with caseous pneumonia, having improved during a winter at the spot, have lost their gain through the fierce winds of spring. Meanwhile, pending the verdict of experience, the recovery of phthisical people in the Andes, as in the singularly dry and calm vale of Huanuco, scarcely furnishes a sound argument in favour of the plan. Even as matter of analogy the illustration fails. At

* *E. g.* Dr H. Weber, *Med. Chir. Tr.*, vol. 52. 1869.

† "St. Moritz," by R. W. Hewlett, 1871.

‡ Hewlett, *loc. cit.*, p. 38. The meteorological observations were actually taken at Bevern, a village four miles N.E. of St. Moritz; but according to Dr. Hewlett, they fairly represent the climate of this latter place.

Huanuco the temperature ranged, according to Dr. Smith, for three consecutive years in an open verandah from 66° to 72° ; * what similarity of result can be expected from sojourn in an elevated site in Switzerland, amid mist, fog, damp, the fiercest cold, frost, ice and snow,†—in spots, too, where the food, as throughout Switzerland, is, from the British point of view, indigestible and innutritious? ‡

“And shall I, if I make the sacrifice of wintering in this far-away spot, be surely healed?” has the physician again and again been asked by those his *fiat* had condemned to a Mediterranean exile. “That,” he may have replied, “we cannot promise. But at least you will secure yourself a winter of comparative physical enjoyment: your day will be long for the season; sun, more or less brilliant, will be your almost daily companion; the air, if not uniformly, will commonly be balmy and genial; a scene of ever-varying beauty will charm your sight; the fragrance of flowers will minister to another sense; while, cradled in your hammock slung among olive trees, whose grateful shade protects you from a too vivid sun, the chirping of birds and the hum of insect life, harmonising with the gentle splash of the near-by sea, will many and many a day soothe you into passing oblivion of pulmonary and all other woes.”

But all this, it is proposed, should be changed. To the same question the physician, consigning his patient to an Alpine height, is invited to reply. “No! we cannot precisely promise cure. But at least you will insure yourself as much physical discomfort as can readily be obtained, unless you consent to journey to Siberia; your day will be as short as possible; the absence of sun will be your rule; the air, if not abidingly, will commonly be rawly, penetratingly, and intensely cold; your scenery will be one endless vista of snow; your amusements will be sledging and skating; to protect yourself from the elements, you will find real refuge in bed

* *Dub. Med. Jour.*, *loc. cit.*, p. 340.

† A *native* of St. Petersburg, who had been sent thence to pass the summer at St. Moritz, and the winter in the Isle of Wight, came under my notice in the spring of 1871. He told me the cold proved so bitter at St. Moritz in August, that he was obliged frequently to wear his winter paletots. It is true, however, the air is habitually more still in the winter than in the summer and autumn months.

‡ *Out-ils donc une spécialité de la grande dure!* as I once heard a lady exclaim at a *table d'hôte* in Geneva—that is, in the Paris or London of Switzerland. Fancy the bill of fare through the long, long dreary winter at a place like St. Moritz, where, if anywhere, one might suppose, in the phrase of Richat, *le goût serait le dernier fil, auquel tiendrait le bonheur d'exister.*

alone; * if even there will be none, olive-trees there will be none, song of birds there will be none, but there will be solitude, gloom, and desolation around sufficient in one sense to smoothe the passage to the grave."

Verily, the sage of old was right: *Medicina ara incerta est!*

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Even as a summer halting-place for pulmonary invalids returning from Southern France or Italy, St. Moritz seems a hazardous choice. It is during the summer months the cold becomes in one form most trying, from the ferocity of the winds that sweep the valley.

Monte Grappa, at an altitude of 3700 feet; Bormio, + 4200 feet above the sea-level, looking south, and for its elevation unusually sunny; Tarasp; at about the same height, in the Lower Engadine, and perhaps even Davos, 4800 feet above the sea, are elevated spots that might, however, be utilized with advantage in summer by a small proportion of such invalids.

* "A great source of warning the patient is conspicuous only by its absence." —

• "The Climate of Bormio," Meyer-Altmann and Bruggen. Zurich, 1869.

• "Klima, Wetter u. Tarasp," Meyer, 1866.

CHAPTER II.

SEA VOYAGES.

1615. "SAILING or living at sea," to adopt the quaint language of Gilchrist, "though for many ages past scarce mentioned in relation to medicine, seems, nevertheless, to have held a distinguished rank among the great remedies of antiquity." * The enthusiastic advocacy of Gilchrist restored marine life, even under the miserable conditions of the voyaging of his period, to favour as a remedy, especially for consumption. Looking at the question theoretically, Gilchrist argued that the constitution of the sea-air [1527, *a a*], sea-sickness; the constant passive exercise, augmented by storms; the total change of manner of life, the rarity of colds, form so many elements of advantage,—while hæmoptysis is cured by sailing, and phthisical people do not suffer from *protracted* sea-sickness.

But all these theoretical arguments have been met by other writers with flat negatives. Sea-air, it is said, is doubtless pure, but it is excessively damp; † sea-sickness is injurious; colds are peculiarly common among naval men,—epidemics of bronchitis frequently occurring on board under the influence of atmospheric changes, &c. ‡ Gilchrist, in all honesty, reports a certain number of favourable cases which, were they satisfactory in detail, would be worth all the arguments in the world; but, unfortunately, they are deficient in this essential quality.

Opinion seems to have been in a state of oscillation, now hostile now favourable, as to the utility of sea-voyages, when the latter view was rudely and systematically assailed by Jules Rochard. Rochard writes with the air of a partizan; but the body of evidence he has collected, to dispel the delusive faith, as he regards it, in the preventive or curative efficacy of maritime life in regard of phthisis, is certainly striking, as far as it goes. He shows, from the records

* "Use of Sea Voyages in Medicine," Pref. p. xii. 1771.

† This Gilchrist fully admits,—he even accepts the calculation that 6250 million tons of vapour rise from the surface of the Mediterranean in a summer's day.

‡ Rochard, "Influence de la Navigation et des Pays chauds, &c.," *Mém. de l'Acad. de Med.*, t. xx. p. 103. 1856.

of various French ships of war, as well as from the mortality among discharged sailors and throughout the French navy, "that phthisis, far from being uncommon among sailors, is, on the contrary, much more common among them than among soldiers," . . . "that, with rare exceptions, the course of phthisis is more rapid on board ship than on land." To the ready objection that the navy are sent indiscriminately to all latitudes and all climes—the inappropriate as well as the appropriate—Rochard replies by anticipation, that his conclusions are based on facts collected at a time, when the French navy cruised almost wholly within the Torrid Zone. But the rejoinder may be made, that *great heat* (as insisted on by no one more strongly than himself) is very decidedly prejudicial in phthisis,—and that the possibly beneficial influences of sea-life, in the instances he quotes, had consequently been virtually annulled by proximity to the equator. It may be urged, too, that sailors are obliged to leave their beds in all weathers, and take their turn for the watch on deck.*

And in truth, Rochard admits, inferentially, that voyaging might be useful in phthisis under special hygienic arrangements, and if the vessel were navigated according to change of season in well-selected climates.† He here seems to concede the whole matter in debate in a sense opposed to his general argument.

The latest contribution of note on the subject is by a physician, himself a sufferer from "phthisis," who "recovered on a sea-voyage."‡ His experience concerns especially the Australian trip, and his practical details are well deserving of study. He as warmly advocates the voyage in the early, as he deprecates it in the advanced, conditions of the disease. A few narratives of cases are appended in support of this qualified approval.

1916. For my own part, I have no hesitation in avowing my belief that, if downright bad climates be avoided, a long sea-voyage, or a protracted cruise, is a remedial measure of real value. It will especially be likely to prove so, if the patient be "fond of the sea." The improvement of appetite, the increased facility of digestion (especially of fat), and hence the increase of weight and of strength, are sometimes as rapid as they are marked. Of course, the early sea-sickness must have passed away, before these results are observed; and occasionally, when in the neighbourhood of

* This fact alone would make it plain that youths of phthisical proclivities should never be permitted to enter the Navy.

† Loc. cit., p. 167.

‡ Dr. MacLaren, Brit. and For. Med. Review., p. 122, Jan. 1, 1871.

the line (where the Australian voyage is that taken), the great heat may bring back the perspirations the patient had lost,—destroying his appetite, and in all respects throw him back for a while . . . but only for a while. Not only do I believe with Gilchrist, that there is no special danger of hæmoptysis, but, as I have several times known, the disposition to constantly recurring hæmorrhage may be effectually checked by the combined influences of life afloat.

1617. It is essential that the season for the voyage be well chosen, that the vessel be freely ventilated below, and thoroughly well provisioned, and that dangerously changeable, stormy, and rawly cold latitudes be absolutely shunned. As already mentioned, I have known all the advantages (where they had been great) of the outward voyage by the Cape of Good Hope to Australia totally lost through the return round Cape Horn in companionship for a certain time with icebergs.

1618. Without attempting to discredit the general wisdom of Dr. Maclaren's prohibition of the sea in advanced cases, I would simply observe, that I have in not a few instances known the Australian trip followed by practical recovery, where excavations, active disintegration, and more or less copious hæmoptysis proved the local advancement of the disease; while the systemic sympathy was shown in anorexia, indigestion, diarrhoea, colliquative perspirations and extreme emaciation. On the other hand, I have seen patients lose ground seriously, in whom the disease, both locally and generally, had, as it were, but just budded into life.

1619. To sum up: a sea-voyage, more especially in the case of young adult males, will, I think, occasionally work more effectual change in the phthisical organism than any other single influence, or any combination of influences, that I am acquainted with. Not only have I seen the local disease stayed, and the damaged lungs attain the maximum of possible repair, but the whole constitution undergo such remodelling, as to render a fresh outbreak of the tuberculising process an unlikelihood.

Believing, thus, in the utility of well-directed voyages, I cannot help deeply regretting the failure, from want of support, of a thoroughly well-planned project, started some two years ago.* It was proposed, a large steamer, fitted up with elaborate attention to hygienic requirements, and provided with every appliance for luxurious yacht life, should cruise, under the command of an ex-

* By Lieutenant Gray, R. N. R.

perienced naval officer, from port to port in warm, but not tropical latitudes, and with constant reference to the climatic conditions of each at the various seasons.

It appears difficult to imagine any plan by which the benefits of climatic change could be so completely secured (at least under high barometric pressure) as by that now sketched. Every possible ill-influence, which the sharp ingenuity of Rochard has succeeded in proving or imagining, is obviated by the conditions under which, were this project eventually carried out, the pulmonary invalid might while away a charmed existence at sea.

ADDENDA.

P. 192.

DIAPHRAGMATIC HERNIA.

SINCE the above page was written, I have learned through an elaborate paper by Bowditch (quoted by Flint on Respiration Organs, 1st ed., p. 604), that the right side has not very unfrequently proved the seat of the hernia,—in fact, in 18 of the 59 cases, which, up to the year 1853, appear to have been the total number recorded. The liver, too, as well as the spleen, may be displaced through the septum.

P. 332.

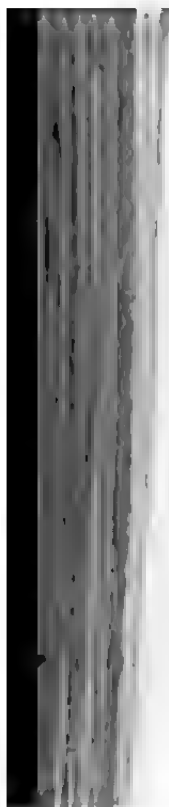
COMPRESSED AIR-BATH.

That the opinion of the French Academy of Sciences has completely changed concerning the value of this agent, is sufficiently proved by their having at last (better late than never) awarded M. Junod the principal Monthyon prize for 1870, as the author of the earliest authentic experiments on the influence of compressed air on the human body.

P. 648.

SANTA FE DE BOGOTÀ.

Ubaque and Fusagasuga are yet more trustworthy spots than their neighbour Bogotà.



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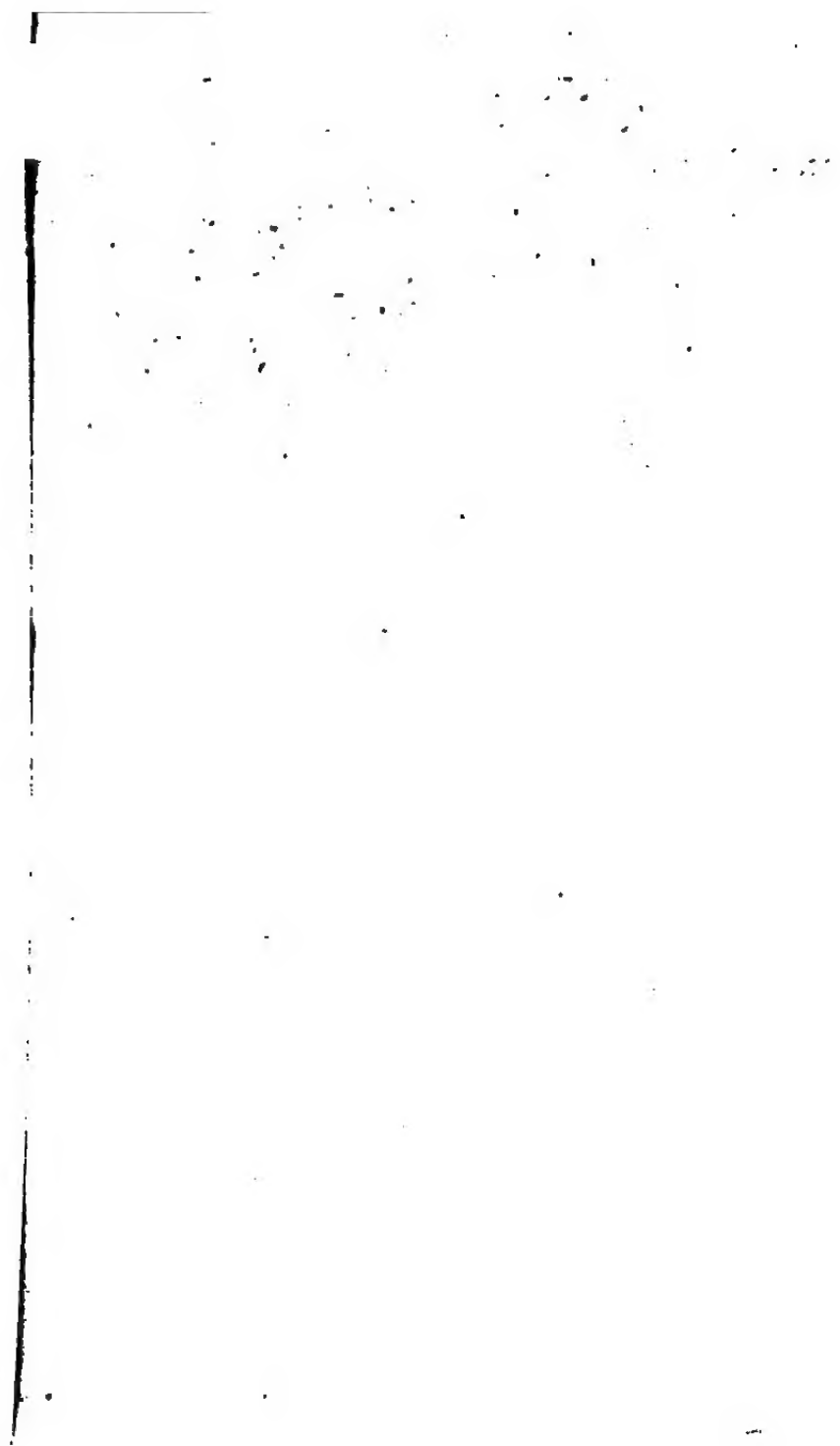
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[The letters U. C. H. stand for University College Hospital.]

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